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BRONCHOGRAPHY IN CHILDREN*

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IMPRESSED by the frequency of bronchial alterations in the sequelae of primary and reinfection tuberculosis in children,[2,3,4,5] we decided to study, by means of bronchoscopy and bronchography, the bronchial lesions of the children in the Sanitarium. Dr. Teodosio Valledor[6] had pointed out the frequency of bronchial obstruction and dilatation in children who had recovered from primary tuberculosis and Dr. R. Garcia Mendoza[1] had proved in a postmortem that a primary tuberculous ulceration had caused the obstruction of a bronchus.

Every child suspected of bronchial pathology was examined by means of bronchoscopy, bronchography with iodized oil, or both. We were soon aware of the limitations of bronchoscopy, especially in small children. Local anesthesia with pantocain or cocaine is dangerous, and it is hard to see through a tube 4 or 5 millimeters in diameter in a wriggling child. Even in older children, as in the adult, the field of vision of the bronchoscope is limited, and it was common to find a negative bronchoscopic examination followed by a bronchogram showing definite bronchial pathology.

Our main interest has been to study the bronchi in primary tuberculosis during the active phase and posteriorly, especially those cases showing segmental or lobar infiltration and atelectasis. These forms are frequent in small children, where the technical difficulties for the practice of bronchographic examinations are great. With our bronchoscopist, Dr. José M. Rouco, we have developed a technique that has enabled us to obtain, without any accidents, bronchograms in children five, eight and ten months of age. In children under two or three years no local or general anesthesia is used. It may be useful to give the child an appropriate dose of barbiturates half an hour previous to the examination. The child is inmobilized by placing his arms and legs in cardboard tubes and passing the compression bands over the lower extremities. An assistant elevates the arms and positions the patient. A gag (generally used for tonsillectomy) is placed in the mouth and with the index finger of the left hand acting as a guide (touching the epiglottis or the arytenoids), a No. 12 (French gauge) catheter mounted on a metallic mandrin is slipped into the trachea. The mandrin, previously lubricated by a drop of lipiodol, is extracted and the catheter

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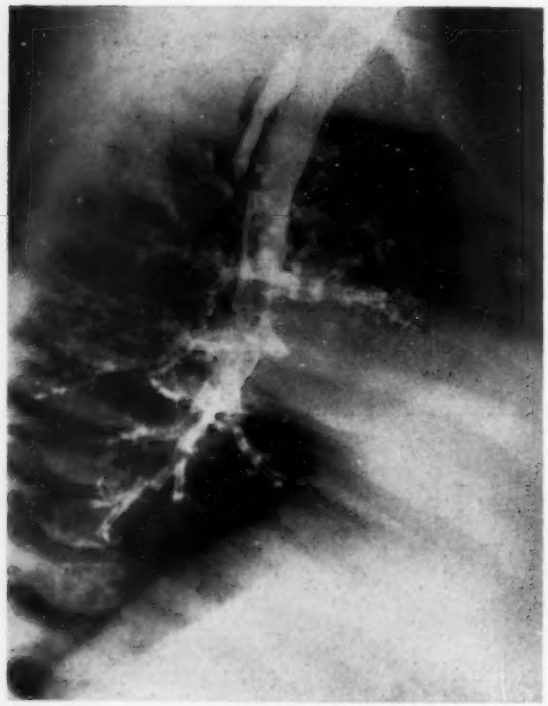

Fig. 1. Complete "stop" of the middle lobe bronchus resembling a ligature or a tumor.

Fig. 2. Stricture of the middle lobe bronchus with large irregular dilatation of its branches. The enlarged lymph glands can almost be "seen" by the compression of the surrounding bronchi.

left in place. The position of the catheter is controlled by manipulations under the fluoroscopic screen until it is in the right or left bronchus as desired. With the child positioned on the cassette, the iodized oil is injected rapidly and the first film taken as the catheter is removed exactly at the end

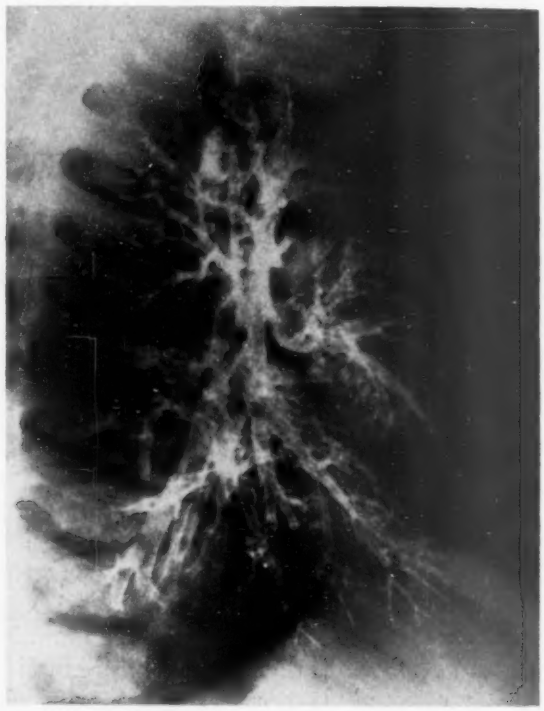

Fig. 3. Complete "stop" of the anterolateral branch of the upper lobe bronchus. Middle lobe bronchus and its branches "elevated" and "bent" by the collapse of the adjoining anterolateral segment of the upper lobe.

of the injection. The exposure should not be more than one-sixtieth of a second. We take the lateral film first and oblique and anteroposterior films in rapid succession. The child expectorates the lipiodol (40 per cent) very rapidly (swallowing most of it) and if care has been taken not to block a small bronchus with the tip of the catheter and inject it under pressure, the next day there is hardly a trace of opaque oil in the lung. In 152 cases examined we have had no accidents or complications and the evolution of the lesions has not been altered.

In primary tuberculosis, the character-

istic roentgen image is given by the primary complex. This complex is formed by three principal elements, the primary node (Ghon's or Parrot-Küss's node), the enlarged lymph glands and the intermediate lymphangitis. There is no need to give a description of their well known roentgenological characteristics. I must point out, however, that these elements are masked quite often by primary and secondary in-

Fig. 4. "String bean" image of the middle lobe bronchus. Anterolateral branch of the upper lobe bronchus "descended" by the collapse of the adjoining middle lobe.

filtrations of the surrounding lung. Furthermore, lobar and segmental collapse of the lung is frequent (atelectasis). In order to localize these lesions correctly, it is necessary to take at least two films, front and lateral, and to have in mind the bronchial distribution and segmentation of the lungs. We base our descriptions on Foster-Carter and Hoyle's schema.

Our bronchographic studies have shown that in primary tuberculosis simple infiltration is the exception, atelectasis is the

Fig. 5. Less typical "string bean" middle lobe bronchus with ampullar dilatation of one of its branches.

Fig. 6. "String bean" middle lobe bronchus.

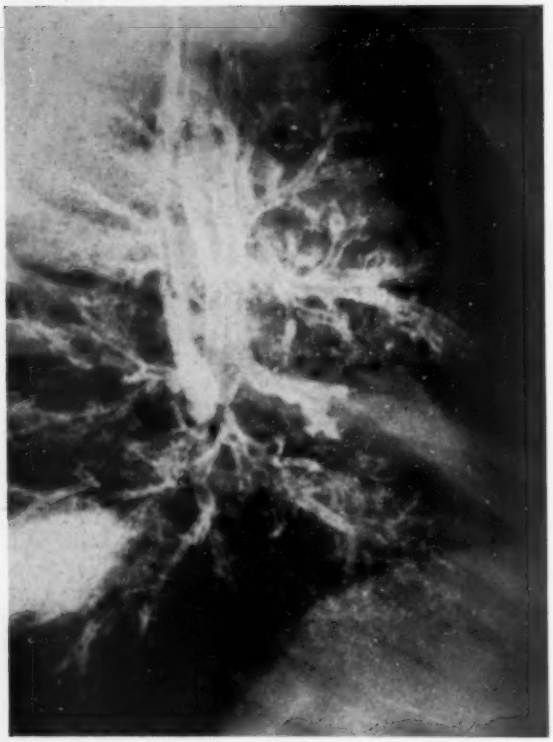

FIG. 7. "String bean" middle lobe bronchus. The catheter blocked a posterior basal branch of the lower lobe bronchus injecting it under pressure in an earlier attempt of bronchography.

rule. The cause of the collapse may be compression by enlarged lymph nodes or lesions that seem to arise from the bronchial wall itself. The bronchus of the middle lobe is by far the one most frequently affected, atelectasis of this lobe showing a typical triangular opacity in posteroanterior films and wedge-shaped in the lateral projection.

Infiltration and atelectasis frequently coexist, one or the other predominating. Total collapse of the lung, exceptional in primary tuberculosis, is easily recognized by the dense opacity, the retraction of the thoracic skeleton, the shifting of the mediastinum and the elevation of the diaphragm. More limited lobar or segmental collapse is recognized by the homogeneous, "ground glass," medium dense opacity, displacement and arching of the interlobar fissures, volumetric reduction of the lobe or segment and diminished density of the adjacent normal lung, with greater separation of its bronchovascular markings. This radiolucency may be confused with obstructive emphysema, sometimes present.

In our series of cases showing these images, the bronchogram demonstrated the total or partial obstruction of the bronchi (Fig. 1 and 2). In some cases the bronchi were compressed by enlarged lymph nodes, showing filling defects with smooth contours. In Figure 2, two enlarged lymph nodes can almost be "seen" by the compression and displacement of the surrounding bronchi. In other cases, the constriction seems to arise from the bronchial wall itself, sometimes resembling a ligature or a tumor. (Fig. 1 and 3).

Distal to the obstruction, bronchial dilatation is the rule. It is surprising to see how rapidly bronchial obstruction may cause irreparable damage to the bronchial tree of a young child, as in the case shown in Figure 2, which is of a child ten months old. There is a wide variation of the "type" of bronchiectasis in our cases. We have

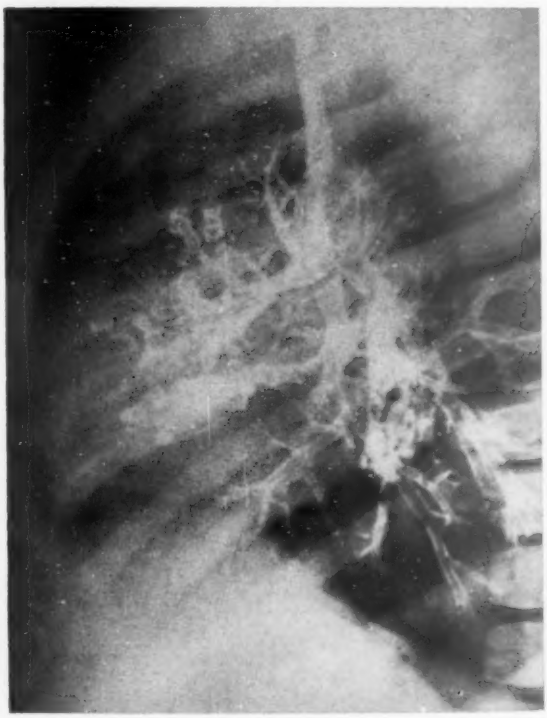

FIG. 8. Small ampullar dilatations of the anterolateral branches of the upper lobe bronchus. "String bean" middle lobe bronchus. Complete collapse of the middle lobe.

found in primary tuberculosis with atelectasis, regardless of whether the lesions are recent or long standing, the coarse, cylindrical, beaded and saccular dilatations common in other bronchopulmonary affections. The main difference lies, however, in the striking frequency with which the middle lobe bronchus is affected and in the fact that in primary tuberculosis there is a

Fig. 9. "String bean" dilatations of the anterolateral branch of the upper lobe bronchus.

tendency to a more strict localization in a lobe or segment (Fig. 11).

A frequent image found in primary tuberculosis with atelectasis and bronchial obstruction and dilatation is shown in Figures 4, 5, 6, 7, 8 and 9. Along the dilated bronchus we find circular incomplete constrictions at regular intervals. The walls assume a "wavy" aspect not unlike a string bean. This is typical of bronchial obstruction in primary tuberculosis, regardless of whether the lesions are recent or long standing.

If the obstruction disappears rapidly, the atelectatic image disappears completely

Fig. 10. Total chronic collapse of the middle lobe with stricture of the middle lobe bronchus and cylindrical dilatation of its branches.

Fig. 11. Coarse ampullar dilatations of the branches of the middle lobe bronchus.

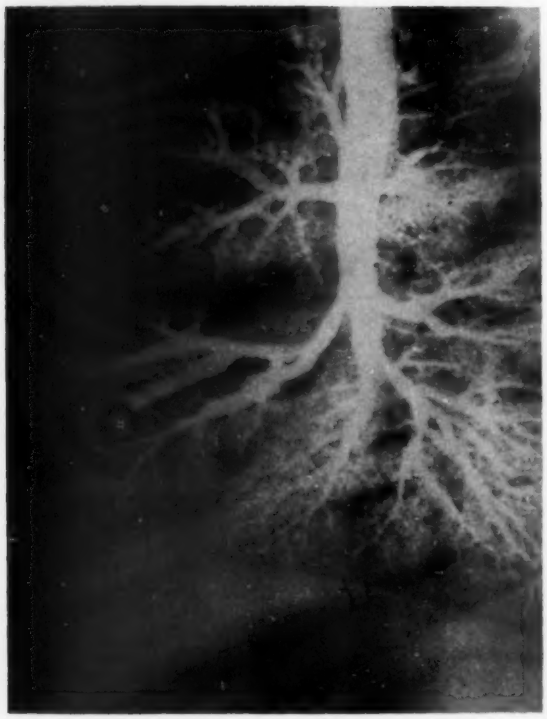

FIG. 12. Slight cylindrical dilatations of the anterior branch of the middle lobe bronchus.

FIG. 13. Same case as in Figure 12 one year later. Stricture of the middle lobe bronchus with dilatation just before its division. Branches normal.

and the bronchus regains almost its normal aspect. In Figure 12, smooth cylindrical dilatations are seen in the anterior branch of the middle lobe bronchus. A bronchogram of the same case taken one year later (Fig. 13) shows a small constriction at the beginning of the middle lobe bronchus with a slight dilatation just before its division into its branches, which appear normal.

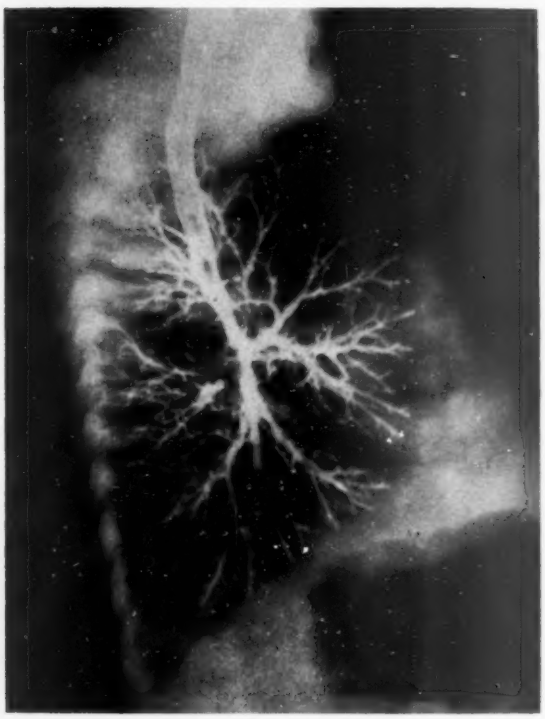

FIG. 14. Child five months old. Compression of the right main bronchus and of the dorsal branch of the lower lobe bronchus by an enlarged lymph gland. No dilatation.

When the collapse becomes permanent (chronic atelectasis) a segment or a whole lobe may be represented by a dense band with radiolucent round or oval zones representing the dilated bronchi. This aspect is interpreted usually as "thickening" of the interlobar septa, residual induration or fibrosis, etc. From the results of our bronchographic studies, we believe that chronic atelectasis is more frequent after primary tuberculosis than is generally admitted.

The case shown in Figure 10, showing complete collapse of the middle lobe with

cylindrical dilatations of its bronchi is of a child who had recovered clinically and roentgenologically from primary tuberculosis. The only abnormality in the chest film (posteroanterior view) was the occupation of the cardiophrenic sinus on the right side by some fibrous strands which seemed of no importance. In the lateral view, the image could be interpreted as a slight thickening of the interlobar septum between the upper and middle lobes. The bronchogram speaks for itself.

Figure 14 is a bronchogram of a child *five months old*, with recent primary tuberculosis. The compression of the main right bronchus at the point of emergence of the dorsal branch of the lower lobe bronchus is clearly seen. Changes in the caliber of the bronchus have not yet had time to develop.

SUMMARY

Using a procedure which is simple and innocuous even in children five and ten months old, we have made bronchographic studies in children with primary tuberculosis of the lungs showing atelectatic collapse of a lobe or one of its bronchopulmonary segments.

Our studies have shown that in these cases the permanent damage to the bronchial tree (stricture and dilatation) appears early and is frequently extensive.

A peculiar form of dilatation resembling a string bean and presenting incomplete strictures at regular intervals is described in this paper.

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REFERENCES

1. Garcia Mendoza, R., Garcia Arrazuria, J. G., and Meneses Manas, R. Un caso de tuberculosis primaria bronquial. *Rev. tuberc., Habana*, 1943, *7*, 3–16.
2. Jones, E. M., Peck, W. M., and Willis, H. S. Bronchiectasis following primary tuberculosis. *Am. J. Dis. Child.*, 1946, *72*, 296–309.
3. Kent, E. M. Bronchial obstruction and pulmonary atelectasis; as seen in childhood tuberculosis with secondary bronchiectasis as sequela. *Am. Rev. Tuberc.*, 1942, *46*, 524–531.
4. Rössle, R. Die pathologisch-anatomischen Grundlagen der Epituberkulose. *Virchows Arch. f. path. Anat.*, 1935, *296*, 1–38.
5. Terplan, K. Anatomical studies on human tuberculosis. *Am. Rev. Tuberc.* (supp.), 1940, *42*, 1–176.
6. Valledor, Teodosio. Personal communication.

THE PTERYGO-ALAR BAR AND ITS RECOGNITION BY ROENTGEN METHODS IN TRIGEMINAL NEURALGIA

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TRIGEMINAL nerve injection for the relief of pain is a common procedure which is not always successful. An anatomical variant, the pterygo-alar bar, may be responsible for some of the failures.

The pterygo-alar bar is probably an ossified pterygo-alar ligament. As such it is similar to ossified petroclinoid ligaments. Extending from the root of the lateral pterygoid lamina of the sphenoid bone to the under surface of its greater wing, the anomaly may exist as a bony ridge or it may help form a foramen which lies along the lateral margin of the foramen ovale (Fig. 1). This foramen, the "porus crotaphitico-buccinatorius," was described by Hyrtl[5] in 1862.

The variant is not rare. One of us (Chouké[1,2]) found it in 7.72 per cent of 6,000 dried skulls. In some, the bar was thin and incomplete; in others, it was solid and approached 4 millimeters in width.

FIG. 1. Photograph of base of skull made in slightly oblique position. The foramen ovale is seen at *1*, the pterygo-alar bar is seen at *a*, and the porus crotaphitico-buccinatorius is seen at *2*.

De Froe and Wagenaar[3] were probably the first to recognize and demonstrate this anomaly roentgenographically. They called attention to it in 1935 when they stressed its importance as an obstacle to the injecting needle inserted through the lateral route.

The method they described for demonstrating the bar, excellent though it was, failed to gain proper recognition because it was too difficult for common use. This stimulated our interest in the problem.

Dried skulls with well demonstrated pterygo-alar bars were roentgenographed in various projections. It was soon obvious that the ordinary base view of the skull (mentocoronal, Hirtz[4]) demonstrated the bars with ease in films of high roentgenographic quality. Our observations in the anatomical specimens were then applied to routine roentgenograms of skulls made for clinical purposes.

Eighty-seven pterygo-alar bars were found in 1,234 patients (7.05 per cent). Of these, 29 (2.35 per cent) were found on the right side of the skull, 36 on the left side (2.9 per cent), and in 11 they were bilateral (0.89 per cent). Whereas one could not always determine whether the bar was complete or incomplete, its thickness was identified with ease.

Roentgenographically the pterygo-alar bar is represented by a zone of increased bone density intimately connected with the lateral margin of the foramen ovale. In this position, it almost always gives the outer margin of the porus an unusually eburnated density (Fig. 2 and 3). Occasionally, the

Fig. 2. Arrows point to a pterygo-alar bar along the lateral margin of the foramen ovale.

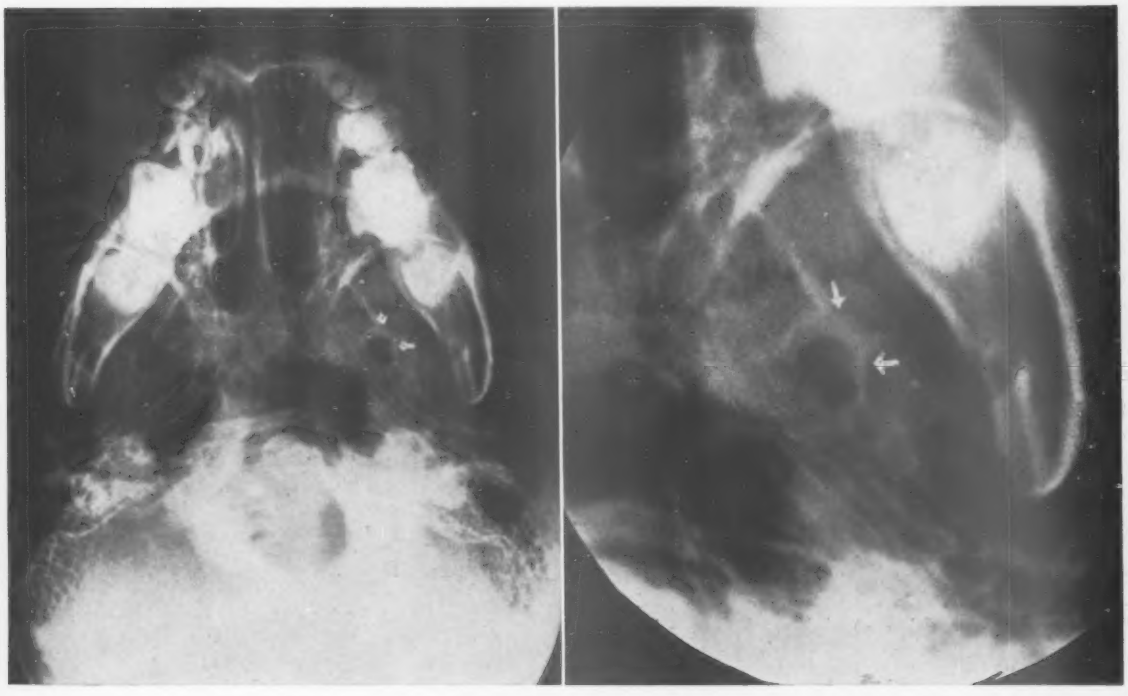

Fig. 3. Arrows point to a pterygo-alar bar along the lateral margin of the foramen ovale.

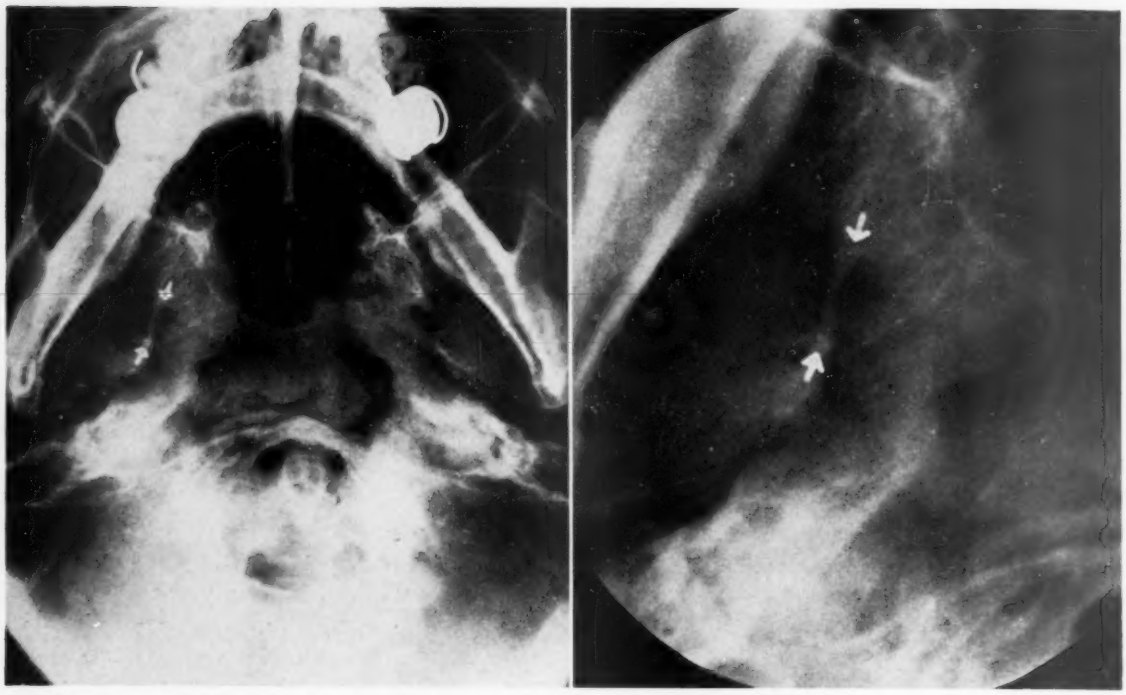

FIG. 4. Arrows point to a pterygo-alar bar which transects the foramen ovale like a bridge of bone.

bar may be seen transecting the foramen like a bridge of bone, an appearance strikingly demonstrated in stereoscopic films of the base of the skull (Fig. 4). In many patients, it is seen with difficulty.

Penman[6] and more recently Sweet[7] emphasized the importance of roentgenographic control during trigeminal injections. With it, they obtained more satisfactory anesthesia in a much higher percentage of patients. It seems reasonable to believe that the recognition of the pterygo-alar bar by roentgen means may increase still further their percentage of successful injections.

SUMMARY

1. The pterygo-alar bar is a bony anomaly which lies along the lateral margin of the foramen ovale.

2. Because of its position, it may interfere with successful injection of the mandibular division of the trigeminal nerve via the lateral route.

3. The anomaly can be identified in routine roentgenograms of the base of the skull when they are properly positioned and of high diagnostic quality.

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REFERENCES

1. CHOUKÉ, K. S. On incidence of foramen of Civinini and Porus crotaphitico-buccinatorius in American whites and Negroes. *Am. J. Phys. Anthropol.*, 1946, *4*, 203–225.
2. CHOUKÉ, K. S. Injection of mandibular nerve and gasserian ganglion; anatomic study. *Am. J. Surg.*, 1949, *78*, 80–85.
3. DE FROE, A., and WAGENAAR, J. H. Die Bedeutung des Porus crotaphitico-buccinatorius und des Foramen pterygo-spinosum für Neurologie und Röntgenologie. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1935, *52*, 64–69.
4. HIRTZ, E.-J. La radiographie de la base du crâne. *J. de radiol. et d'électrol.*, 1922, *6*, 253–263.
5. HYRTL, J. Über den Porus crotaphitico-buccinatorius beim Menschen. *Sitzungsberichte d. Kaiserl. Akademie der Wissenschaften zu Wien, Natur-mathem.*, 1862, *46*, 111–115.
6. PENMAN, J. Simple radiological aid to gasserian injection. *Lancet*, 1949, *2*, 268–274.
7. SWEET, W. H. Trigeminal injection with radiographic control; technic and results. *J.A.M.A.*, 1950, *142*, 392–396.

AZYGOS LOBE REVEALED BY PLANAR ROENTGENOGRAPHY*

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IN THE early development of the fetus, the azygos vein lies over the right upper lobe outside the parietal pleura. Later it shifts its position so that, in adults, it lies entirely within the mediastinum. It travels cephalad in the posterior portion of the right chest, lying anterior to the inner surface of the ribs and posterior to the parietal pleura. It ascends to about the level of the fifth rib and then curves anteriorly to join the superior vena cava just before that vessel enters the right auricle.[3,4]

If the vein should fail to shift in position, it must run forward and medially to reach the vena cava. It then makes a deep cleft in the upper lobe, drawing down a double fold of both parietal and visceral pleurae which is known as the azygos membrane. This lies in a plane perpendicular to the posteroanterior roengenongram. The part of the upper lobe split from the main portion is known as the azygos lobe.

The roentgenographic appearance of the lobe, or rather of its lower lateral border, was noted first by Wessler and Jaches[5] in 1923. The significance of the shadow was not realized. In 1928, Bendick and Wessler[1] correlated the roentgenographic findings with necropsy study in 2 cases and reported the correct interpretation of the shadow. This is a fine line, representing the azygos membrane, which runs down from

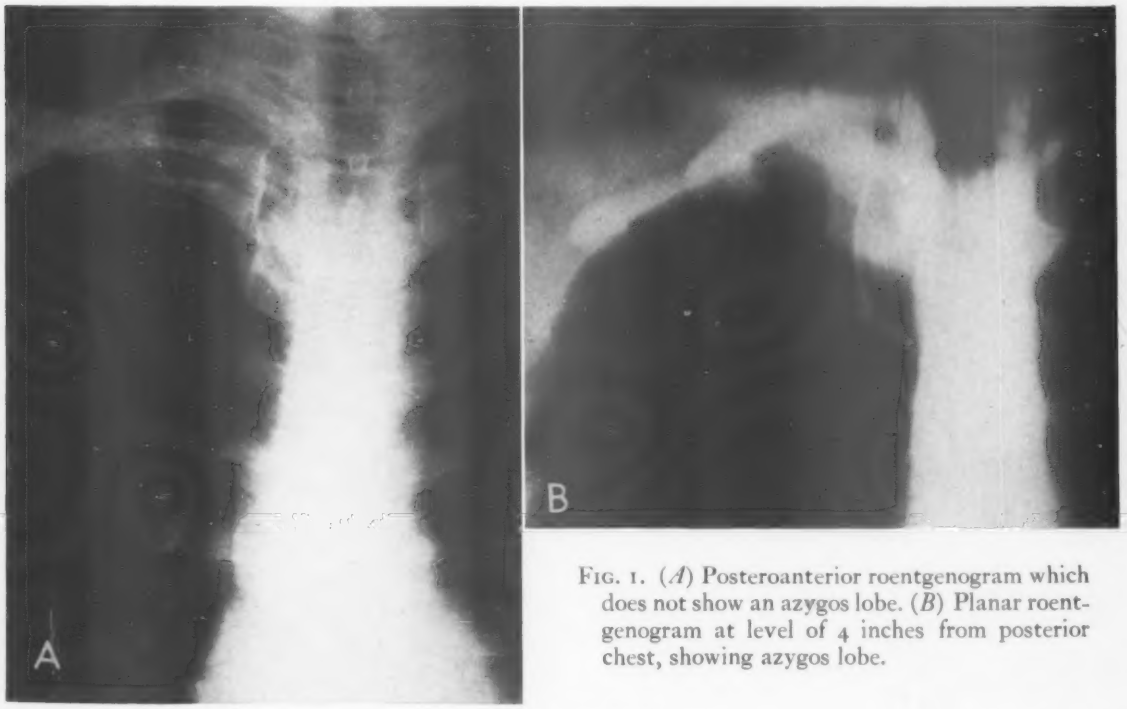

FIG. 1. (*A*) Posteroanterior roentgenogram which does not show an azygos lobe. (*B*) Planar roentgenogram at level of 4 inches from posterior chest, showing azygos lobe.

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the right apex, curving downward and inward with its convexity lateral, to end just below the level of the first costal cartilage in a dense circular or pear-shaped shadow (the azygos vein).

The incidence of azygos lobe has been estimated as 1 in 175 to 200.[2] The position of the membrane may vary, and its shadow may be obscured by overlying lung and thus may not be visible in plain roentgenograms. It is therefore of interest to record the case of a young man who was admitted to the Montefiore Hospital Country Sanatorium for treatment of tuberculosis. Planar roentgenograms showed an azygos lobe (Fig. 1*B*) which was not discernible in the posteroanterior roentgenogram (Fig. 1*A*). When artificial pneumothorax was induced in this case, the azygos lobe failed to separate with the rest of the right upper lobe and was then clearly visible on ordinary roentgenograms.

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REFERENCES

1. BENDICK, A. J., and WESSLER, H. Azygos lobe of lung. AM. J. ROENTGENOL. & RAD. THERAPY, 1928, *20*, 1–6.
2. HARRIS, K., and KERLEY, P. Vena azygos lobe with haemoptysis. *Proc. Roy. Soc. Med.*, 1934, *27*, 1231–1232.
3. RABIN, C. B. In: Diagnostic Roentgenology. Ross Golden, Editor. Thomas Nelson & Sons, New York, 1936, p. 74.
4. ROTHSTEIN, E. Azygos lobe; its involvement in pulmonary disease. AM. J. ROENTGENOL. & RAD. THERAPY, 1949, *61*, 195–198.
5. WESSLER, H., and JACHES, L. Clinical Roentgenology of Diseases of the Chest. The Southworth Company, Troy, New York, 1923, p. 17.

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CYSTS OF THE KIDNEY*

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MY INTEREST in cysts of the kidneys has been stimulated by personal errors in roentgen interpretation. A review of the literature confirmed our confidence in the fact that our experience is not unique. Though there are certain criteria which are helpful in differential diagnosis, none are infallible, and it is highly important that renal malignancy be considered whenever one encounters what appears to be a simple cyst.

To treat a patient who has an hemorrhagic cyst as a case of hypernephroma is no less exasperating than to watch a patient, whom we thought had a simple cyst, develop the characteristic manifestations of hypernephroma. In a futile effort to clarify the situation, I have reviewed our cases of renal cyst for the years of 1944 to 1948, inclusive. During that period, 107,656 in-patients were admitted to the Methodist Hospital in Indianapolis, and 8,948 cystoscopies were performed. Though no positive criteria for accurate differential diagnosis have evolved from this study, it seemed worthwhile to report our experience. Since my interest was primarily in simple cysts, they will be considered first.

The first written report of renal cysts has been attributed to Fabricius de Hilden,[10] the father of German surgery, in the seventeenth century, a period in which an Englishman, Thomas Willis,[34] also reported his observations. There is a wide variation in the reported clinical incidence of simple cysts of the kidney; and the number found in postmortem examinations indicates that they are more common than the clinical reports would indicate. As Lieberthal[19] stated, small solitary cysts are frequently encountered at autopsy; they are often clinically silent, and may not be palpable or produce urographic evidence of their presence.

Though simple cysts are found most frequently in the fifth and sixth decades, they have, as noted by Fish,[12] been reported to occur at any age, from the fetus to ninety-two years. They are, however, rare in children. The average age of Braasch and Hendrick's[5] patients was 49.8 years, and only 4 were under twenty-one. The average age of Moss's[22] patients was forty-five, and of Lowsley and Curtis's,[20] fifty. The sex incidence is about equal.

Most writers have found that simple cysts of the kidney are more frequently encountered in the lower pole. Next most common site is the upper pole, while cysts are least likely to be found in the central portion of the kidney. Neither kidney seems to be favored.

Many complications of simple cysts of the kidney have been observed, and reports in the literature indicate that renal complications occur in 35 to 40 per cent. There is frequently a concomitant urinary tract infection, but infection of the cyst itself is relatively rare. Calculi are occasionally encountered, either in large simple or calycine cysts. Lowsley and Curtis found calculi in 2 of 19 patients, and Braasch and Hendrick found encysted renal calculi in 16 peripelvic cysts. Calcification may also occur in the walls of a cyst. Though simple cysts are rarely the cause of hypertension, there have been several reports of cases in which there was concomitant hypertension, and in which the blood pressure returned to normal after removal of the kidney. Such cases have been reported by Pearce, Bower and Burns,[25] and by Kreutzmann,[18] who felt

* Presented at the Fiftieth Annual Meeting, American Roentgen Ray Society, Cincinnati, Ohio, Oct. 4–7, 1949.

that nephrectomy is not likely to effect a cure if the increase in blood pressure has existed more than two years.

Those who have written about simple cysts of the kidney are in agreement that, though the plain roentgenogram of the abdomen may be valuable in their detection particularly when they arise in the lower pole of the kidney, the findings on the kidney, ureter and bladder or survey film are seldom conclusive. There may be a rounded shadow of increased density continuous with or adjacent to the renal outline, more smooth and regular than malignant tumors. There may be rotation or change in axis and position of the kidney. Kerr and Gillies[17] described simple cysts as slightly more dense than renal tumors, with the homogeneous appearance of fluid, but Gutierrez[15] was impressed by the visibility of the psoas shadow through the cyst wall.

The pyelogram may be normal, but usually there are variations which suggest the presence of a cyst, though they may not be sufficiently characteristic to permit positive diagnosis. Pyelographic abnormalities include changes in the contour and size of the calices and renal pelvis and disturbances in the position and outline of the ureter. The changes produced by simple cysts may be demonstrated either by the excretory or the retrograde method. Fister[13] found that in 4 of 5 cases the excretory urogram seemed as diagnostic as the retrograde pyelogram.

Braasch and Hendrick listed the calyceal abnormalities in order of frequency as: (1) elongation; (2) dilatation; (3) displacement; (4) flattening; (5) abbreviation; (6) obliteration; (7) crescentic deformity. They described as most typical a crescentic outline of the border of an adjacent calyx. Other writers[12,13,14,26,27] have described the calyces as stretched, elongated, thinned out, displaced, abbreviated, blunted and obliterated.

Kerr and Gillies believed that renal pelvis deformity produced by cysts is less pronounced than that which would be produced by a tumor of the same size, and that the deformity is likely to be one of compression of the pelvis and calyces without the elongation frequently observed in neoplasms. Braasch and Hendrick listed the pelvic deformities in order of frequency as: (1) dilatation; (2) displacement; (3) general deformity; (4) flattening of the border adjacent to the cyst; (5) none. Like Kerr and Gillies, they found the deformity produced by neoplasms to be more extensive than that produced by cysts. Gutierrez observed displacement, rotation, and a crescentic deformity of the renal pelvis. Abnormalities in the ureter have been said to include compression and displacement.

We have surgical proof of the existence of calycine or large simple cysts of the kidney in several of our patients. Diagnosis was based solely on clinical and urographic evidence in others.

The symptoms of the patients who had either surgical or clinical evidence of large simple cysts were quite variable. One patient had noticed an abdominal tumor; one had a dragging sensation in the flank; one had hematuria; and one had pain in the back and flank. One patient who had prostatic hypertrophy had straining, urgency and frequency, but no symptoms referable to the renal cyst.

One of the 2 patients who had calycine cysts with associated calculi complained of stone colic, but the other had no symptoms referable to the cyst or the calculus, and consulted her physician because of hypertension following a toxemia of pregnancy. A patient who had no demonstrable stones had pain in the right flank.

It was surprising to find that in the period studied, operation was performed on only 2 patients in whom there was characteristic urographic evidence of a large simple cyst. One of these, a woman of sixty-one, had a large serous cyst; enlargement of the lower pole of the right kidney was seen in the primary film, and the pyelogram (Fig. 1) revealed distortion of the pelvis and elongation with characteristic crescentic pressure deformity of the

lower calyces, both major and minor. A midddle major calyx was elongated, displaced downward, and the associated minor calyces were dilated. The lower pole of the kidney was displaced laterally. An error was made in the other, a man of fifty-one who consulted his physician because of a tumor in the left flank. The preliminary film revealed a tumor 13 cm. in diameter, the shadow of which was largely below but partially superimposed on that of the lower pole of the left kidney, and appeared

Fig. 1. Large serous cyst, right.

to be separate from the kidney. The interpretation of the excretory urogram (Fig. 2) was that the tumor was extra-urinary. In retrospect, I believe that the appearance of the calyces should have led to the correct conclusion. If the tumor were extra-urinary, there should have been evidence of pressure upon, rather than downward traction on the kidney. The elongation of the lower calyces and relative shortening or compression of the middle and upper calyces suggest that traction had been exerted upon the lower pole of the kidney by the weight of the tumor in this region; the surgeon found a large simple serous cyst of the kidney. Another patient had surgical and urographic evidence of calculous pyelonephritis; the calyces were only partially outlined in the pyelogram. Therefore, it was not surprising to find at operation that this woman of seventy-two had a

Fig. 2. Large serous cyst, left.

cortical cyst, 1.5 cm. in diameter, whose existence we had not suspected.

The urologist and radiologist agreed that there was sufficient evidence for a clinical diagnosis of large simple cyst in 2 other cases, neither of whom was operated upon. Both were men, one sixty-five and the other forty-two. In the first instance, the tumor mass was well defined and in the second, indistinct. In each there was a crescentic deformity of some of the calyces, and in neither was there much variation from the normal appearance of the ureter, or in the long axis of the kidney. The renal pelvis was deformed by pressure in one but was undistorted in the other.

A pyelographic deformity characteristic

Fig. 3. Simple cyst, right. (Clinical only.)

FIG. 4. Calycine cysts, upper pole, right.

of large simple serous cyst was demonstrated in 2 patients who were examined just prior to the period studied. In one of these, a man of sixty-five, there was surgical confirmation, but operation was refused by the other, a man of fifty-two. In the surgical case (Fig. 3), the preliminary film disclosed an 11 cm. mass at the lower pole of the right kidney; the lower major calyx was elongated, elevated and displaced laterally; the minor calyces were rounded; the renal pelvis was moderately dilated; the lower pole of the kidney was considerably displaced laterally, and the upper third of the ureter was slightly displaced medially. In the other patient the tumor shadow was not sharply outlined; the lower major calyx was elongated and displaced upward and laterally and with the minor calyces presented a slight crescentic deformity. There was a slight defect in the inferior border of the renal pelvis; the ureter was not displaced, but there was a slight lateral displacement of the lower pole of the kidney.

Nephrectomy was performed in 2 patients who had renal calculi, who had no pyelographic study, and in whose kidneys simple serous cysts of moderate size were demonstrated.

Pooling the group of surgically proved and clinically accepted simple serous cysts of the kidney, 2.5 cm. in diameter or over, it is found that the lesion was on the right in 6, on the left in 3, and in the lower pole in each case. In none was there significant anemia or disturbance of renal function, but there was urinary tract infection in 3 of the 9 cases. The systolic blood pressure was elevated in 4 (156, 185, 195 and 210 mm. Hg.), but the diastolic blood pressure was above normal in only 3 (90, 110 and 120 mm. Hg.).

Calycine cysts are small cortical activities which communicate with a minor calyx

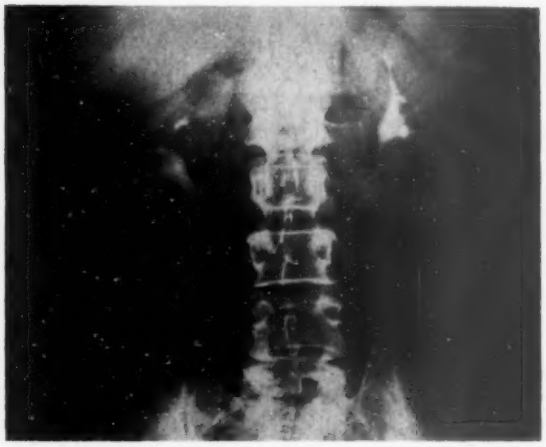

FIG. 5. Negative excretory urogram, 1944.

and are situated just distal thereto. Our series includes 3 cases, 2 in the upper and 1 in the lower pole, 2 in the right kidney and 1 in the left. A woman of thirty-six (Fig. 4) had what appeared to be two calycine cysts in the upper pole of the right kidney with associated calculi; the surgical pathologist demonstrated these as cysts 1.5 cm. and 2.5 cm. in diameter. There was a clinical diagnosis of calycine cyst in 2 other patients, one a woman of thirty-five, who had a stone in the cyst, and the other a man of fifty-one. In each instance a cystic cavity, roughly circular and less than 1 cm. in diameter was just distal to and communicated with a minor calyx.

Two of the 4 patients who had evidence of calycine cysts had elevation of systolic pressure (185 and 210 mm. Hg.), but only 1 had elevation of the diastolic blood pressure (120 mm. Hg.). There was evidence of urinary tract infection in 2 patients, and

of renal calculus in one. Two patients had a mild anemia.

HEMORRHAGIC CYSTS

The fact that hemorrhagic cysts of the kidney are not encountered so frequently as simple cysts has been emphasized by Bockus, Krohn and Mullen.[3] In 1931, Munger[23] was able to find in the literature only 19 cases in which there was adequate pathological proof of the presence of an hemorrhagic cyst of the kidney. These cysts may arise spontaneously, or as a result of vascular abnormality, trauma or renal malignancy.

Many of the reported cases have followed degeneration of a malignant neoplasm; Lowsley and Curtis[20] believed that this is true in 25 per cent. Herman and Strumia[16] have stated that the term "hemorrhagic cysts" should be limited to those cases in which the cyst is solitary and thick walled.

Fig. 6. Hemorrhagic cyst, lower pole, Left. Same case as Figure 5, 1945.

Hypertension may result from the presence of an hemorrhagic cyst, and Farrell and Young[11] reported such an instance, with relief of the hypertension by nephrectomy.

Scholl[29] has stated that hemorrhagic cysts are smooth, continuous with the contour of the kidney surface, do not project like serous cysts and are usually large and solitary. The urographic findings observed by Braasch were abbreviation of adjacent calyces, compression and flattening of the adjacent portion of the renal pelvis, and change in the position and axis of the kidney as a result of the weight of the cyst. Stirling[31] observed that there is marked deviation of the ureter if the cyst involves the lower pole of the kidney.

We encountered only one instance of hemorrhagic cyst in the period studied. This case, in a man of fifty-five, is of particular interest in view of the fact that an excretory urogram (Fig. 5) was entirely negative on April 20, 1944, and that the urographic evidence of tumor of the lower pole of the left kidney was manifest on March 2, 1945. At the later date (Fig. 6 and 7), the lower pole of the left kidney was definitely enlarged and rotated anteriorly. Retrograde pyelograms in the supine and lateral positions revealed distortion of the lower major calyx, which was displaced anteriorly, appeared compressed in the supine and elongated in the lateral projection. In the supine projection, the middle minor calyces appeared compressed. There was no significant distortion of the renal pelvis or ureter. The changes were thought to be due to the presence of a simple serous cyst; and when nephrectomy was performed, a hemorrhagic cyst 8.5 by 5.0 cm. was found in the lower pole of the kidney.

Fig. 7. Lateral pyelogram on same case as Figure 6.

FIG. 8. Hemorrhagic cyst, left.

Another instance of hemorrhagic cyst occurred earlier than the period studied, but is of sufficient interest to report here. This thirty-six year old woman (Fig. 8) had a large left kidney; the enlargement involved its middle and upper poles. Retrograde pyelography established the presence of a large pressure defect in the renal pelvis, elongation with somewhat crescentic appearance of the upper major calyx, downward displacement of the middle major calyx, and dilatation of the upper minor calyces. It was thought that the patient had a hypernephroma, and preoperative roentgen therapy was given. To our chagrin, surgical exploration later revealed a non-malignant tumor, a hemorrhagic cyst 14 cm. in diameter for which nephrectomy was performed.

In 1 of our 2 patients who had a hemorrhagic cyst, there was hematuria, and a mass was noticed in the kidney region, while the other complained of soreness and a pulling sensation in the lower abdomen, as well as pain in the flank.

No history of trauma was elicited in either of these patients; the second had had an attack of pain in the flank; weakness, nausea and vomiting a few weeks before admission; and at the time of admission there was gross hematuria and a left renal mass. There was no evidence of malignancy in either of these patients, but each had a moderately severe urinary tract infection, and renal function was diminished in one. Neither had significant anemia; one had slight elevation of blood pressure (154/110).

MULTILOCULAR CYSTS

Meland and Braasch,[21] in reporting 6 personal cases of multilocular cyst of the kidney, observed the similarity of these structures to simple or solitary cysts in that they are unilateral, involve similar locations in the kidney and have identical wall structure. Three of their cases were found at postmortem examination, and 3 at surgical exploration. Burrell,[8] who has made an excellent review of the literature, reported 13 cases, 3 of which were found at postmortem examination, 10 at surgical exploration.

FIG. 9. Multilocular cyst, right.

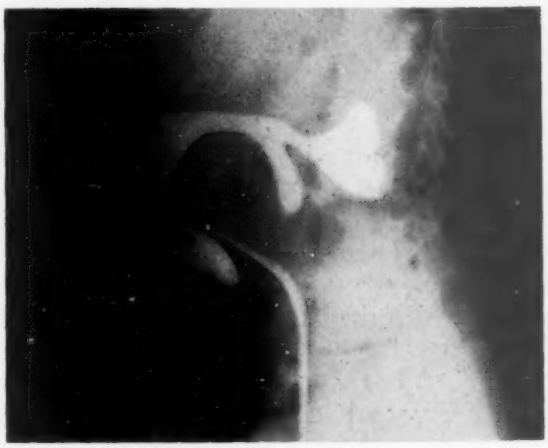

FIG. 10. Lateral pyelogram on same case as Figure 9.

In our series, there were 3 instances of multilocular cyst of the kidney; all occurred in women, and the age distribution was in a narrow range—fifty-five, sixty and sixty-two. There was extreme enlargement and rotation of the right kidney in 1 patient (Fig. 9 and 10). The lower pole of the kidney was markedly displaced anteriorly and somewhat displaced laterally. The upper third of the ureter was displaced medially. All major calyces were elongated, and the minor calyces were markedly dilated. The renal pelvis was displaced upward and rotated anteriorly. The deformity was so great as to suggest the presence of a large hypernephroma, but the surgical pathologic finding was a congenital multilocular peripelvic cyst measuring 9 by 7 cm.

Fig. 11. Multilocular cyst, right.

Fig. 12. Lateral pyelogram on same case as Figure 11.

Fig. 13. Multilocular cyst, right.

An equally bizarre deformity of the excretory system of a moderately enlarged right kidney was seen in another patient (Fig. 11 and 12). The entire kidney and the upper half of the ureter were displaced anteriorly. The pelvis was enlarged, and its lower pole was rotated anteriorly. The major calyces were elongated, and in the lateral projection, the middle and lower calyces presented a crescentic appearance.

Surgical exploration revealed a large multilocular cyst of the kidney. The third patient (Fig. 13) also had urographic changes quite different from those of the ordinary large simple cyst. Enlargement of the upper pole of the right kidney was obscured by the liver. Retrograde pyelography established the presence of a tumor which was assumed to be an hypernephroma. The upper calyces, both major and minor, were markedly distorted, elongated, and crescentic, and appeared to be included in rather than pressed upon by a tumor. The renal pelvis was slightly dilated; the ureter was normal; but the upper pole of the right kidney was slightly displaced laterally. The surgical pathological finding was a multilocular cyst which measured 14.5 by 8 cm.

Only 1 of our patients with multilocular cyst of the kidney had symptoms directly referable to the kidney; and in this case

there was a sensation of tightness, a dull pain in the kidney region, and the patient noticed a tumor. Symptoms in the other 2 patients were vague as far as the urinary tract was concerned.

In each of these cases, the retrograde pyelographic findings were entirely different from those of the ordinary large simple serous cyst. The resemblance to the pyelographic appearance of hypernephroma was striking and deserves emphasis.

Two of the 3 cases of multilocular cyst had evidence of urinary tract infection, but the renal function was normal in all. None had significant anemia, and the blood pressure was elevated in only one (180/95).

POLYCYSTIC DISEASE OF THE KIDNEYS

There have been many case reports of polycystic disease of the kidneys, some unilateral, but the vast majority bilateral. The incidence of bilateral polycystic disease of the kidney was given by Carlson[9] as 1 in 378 postmortem examinations, while the incidence reported by other writers varies from 1 in 229[30] to 1 in 500.[1] Carlson[9] states that the incidence of polycystic disease in a solitary kidney is 1 in 376,000. Nolan[24] observed that 8 per cent of cases of polycystic kidney disease are unilateral. Bell[1] found 44 instances of polycystic disease in 22,393 autopsies; and, of these, 4, or 9 per cent, were unilateral. Waterson and Morgan[33] have stated that congenital cystic liver is found in 19 per cent of patients who have congenital cystic disease of the kidneys, but that Moschcowitz found congenital cystic disease of the kidneys in 75 of 85 patients who had congenital cystic livers. Associated cysts of the pancreas, spleen, ovary and lung have been found in patients who had polycystic disease of the kidneys.

Kerr and Gillies have said that polycystic disease of the kidneys may be discovered at two age periods: the newborn who die as a result, and in people well past middle age, who usually show signs of renal insufficiency.

Dull aching pain in the renal area is said to be a common symptom, and hematuria is said by Bobbitt[2] to occur in 30 to 50 per cent of these patients. Infection was said by Braasch and Schacht[6] to occur in 94 per cent, and certainly the presenting symptoms of these patients are often those produced by infection. Bobbitt reported 1 case of malignant disease of the kidney; and Walters and Braasch[32] reported 3 cases in which malignancy developed in a polycystic kidney. Branham[7] reported a successful pregnancy in a woman of twenty-seven who had a unilateral kidney.

Most writers have described the urographic manifestations of polycystic disease of the kidneys as characteristic, with bizarre sprawling of the calyces and deformity of the pelves of greatly enlarged kidneys. Braasch,[4] in discussing the urographic manifestations of this condition, stated that abnormality in the pelvic outline may not be demonstrated as consistently as in renal neoplasm. Kerr and Gillies described the kidneys as often enormous in polycystic disease, the pelves to be greatly elongated, with relatively reduced volume. They also noted that the minor calyces lose their cup shape, become flattened and distorted by pressure from adjacent cysts, and that arc-shaped depressions occur in many calyces.

In the period studied, polycystic disease of the kidneys was found in 25 patients, of whom 15 were women and 10 were men. The youngest patient was twenty-six and the oldest, sixty-four; the average age was 45.5 years. Eight of these patients had a moderate anemia. Using a systolic blood pressure of 150 mm. Hg. and a diastolic pressure of 90 as the upper limits of normal, the blood pressure was normal in 14 patients and elevated in 11. Only the diastolic pressure was elevated in 2; both systolic and diastolic pressures were elevated in 9; and the highest blood pressure was 230/170. The renal function was depressed in 8 of the 25; but urinary tract infection was rather severe in 12 patients.

The most common complaints of the patients who had polycystic disease of the

kidneys were hematuria and abdominal pain; each was the dominant symptom in 13 of 25 patients. Hematuria was accompanied by increased frequency of urination in 3 instances. Pain was in the left upper abdomen in 6, the right upper abdomen in 3, bilateral upper abdomen in 3, and bilateral lower abdomen in one. Only 5 patients complained of the presence of an abdominal mass, which was in the left upper abdomen in 1, the right upper abdomen in 2 and in both sides of the upper abdomen in two. Two patients were seen because the advisability of interruption of pregnancy was questioned. Other complaints of 1 or 2 patients each were chills, fever, sweating, weakness and fatigue, anorexia, backache and dyspnea.

A majority of the patients who had polycystic disease were studied by retrograde pyelography. Only 8 had excretory urograms, and of these, 1 was unsatisfactory because renal function was depressed, and the excretory system of several others was relatively faintly outlined for the same reason. The preliminary film showed the kidney shadows to be poorly defined in four patients, relatively poorly visualized but apparently enlarged in 12, and to be distinctly enlarged in eight. Four of the 25 patients had urinary calculi. The gross distortion of the excretory system of both kidneys revealed by the pyelogram or urogram was pathognomonic. The bizarre appearance of the markedly deformed calyces and pelves, once seen, can never be forgotten. The major calyces were usually elongated, often narrowed, but more often greatly dilated. The minor calyces were in some instances narrowed, but usually were dilated and greatly elongated; characteristic crescentic deformity was often seen. The renal pelvis was always greatly enlarged; it was often elongated and somewhat distorted; the deformity was frequently asymmetrical. The appearance of the pelvis often suggested that large cysts produced extrinsic pressure on its lumen; the deformity was in the nature of a pressure defect. The long axis of the kidney was

Fig. 14. Polycystic disease.

normal in the majority of patients, but the lower pole of the kidney was displaced laterally in 8 cases, and medially in two. The upper third or half of the ureter was often displaced medially, and sometimes the displacement was pronounced.

Retrograde pyelographic evidence of polycystic disease of the kidneys was well exemplified in a woman of sixty-six (Fig. 14). The kidney shadows were relatively indistinct in outline, but the kidneys were greatly enlarged. The renal pelves were elongated and dilated. The major calyces were elongated; some were crescentic in outline, some were rather narrow, while others were considerably dilated. Most of the minor calyces were enlarged and distorted; some were flattened, but in others, cupping was exaggerated, and there was a crescentic deformity. The long axis of the kidney was almost normal, and there was only slight medial displacement of the upper third of the ureters.

Though the excretory urogram may be quite distinctive of polycystic disease of the kidneys, the deformities are likely to be less clearly outlined by this method than by retrograde pyelography; distortion due to over-distention is, however, absent. A case in point is a woman of forty-three (Fig. 15) in whom the excretory urogram disclosed characteristic sprawling of the calyces, both major and minor, with elongation and crescentic deformity, but

the pelves and ureters were poorly outlined. Even after injection of neo-iopax, the kidney outlines were indistinct. The greater density and more distinct outline of the excretory system obtained by retrograde pyelography is illustrated in a forty year old man (Fig. 16 and 17). The fact that over-distention by the retrograde method may make the deformities seem much more conspicuous is readily apparent.

The renal changes are often asymmetri-

FIG. 15. Polycystic disease; excretory urogram.

FIG. 16. Polycystic disease; excretory urogram.

FIG. 17. Retrograde pyelogram on same case as Figure 16.

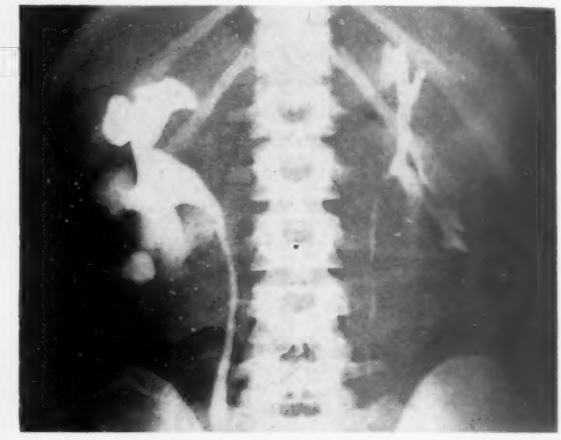

FIG. 18. Polycystic disease.

FIG. 19. Polycystic disease.

cal, and such was the case in a twenty-three year old woman (Fig. 18). Elongation of the calyces was seen in each kidney; but dilatation was apparent on the right, while the major calyces were relatively narrow on the left. Marked asymmetry of the renal excretory systems was found in a woman of twenty-six (Fig. 19) who must have had a large cyst of the lower pole of the left kidney in addition to smaller cysts throughout

both kidneys. Renal calculi were found in 2 patients, 1 a woman of thirty-eight whose stones may have been in calycine cysts, but whose retrograde pyelogram was characteristic of polycystic disease. A forty-nine year old woman had bilateral renal calculi, and a most bizarre deformity of the calyces and renal pelvis; there was a peculiar type of double kidney on the right.

POSSIBLE SOURCES OF POSITIVE ERROR

The ease of making a positive error in a possible calycine or peripelvic cyst was

Fig. 20. Retrograde pyelogram, same case as Figure 21. Hydronephrosis.

illustrated in the case of a thirty-nine year old man. In this case there was no abnormality in the renal outline, but a cystic cavity measuring approximately 4 by 3 cm. communicated with an upper minor calyx; the other calyces were essentially normal. In both the retrograde pyelogram and the excretory urogram, the cyst appeared to protrude beyond the lateral border of the kidney. The cystic area was somewhat too large to justify a diagnosis of calycine cyst; these structures are usually smaller. The surgical pathological diagnosis in this case was chronic pyelonephritis with abscess.

In an early hydronephrosis there may be predominant involvement of one calyx or group of calyces.

Fig. 21. Probable hypernephroma, clinical.

In a woman of twenty-five, dilatation of upper minor calyces seen in the excretory urogram somewhat suggested the presence of calycine cysts in the upper pole of the right kidney. Retrograde pyelography (Fig. 20) five months later revealed a progressive dilatation of all groups of calyces, though the changes were still most pronounced in the upper pole. The excretory system on the left, which had previously been normal, also showed evidence of dilatation.

Another potential source of error was illustrated by a sixty-nine year old man (Fig. 21 and 22); the first examination disclosed a deformity characteristic of hy-

Fig. 22. Same case as Figure 21, eight months later. Hypernephroma, surgical.

pernephroma, and preoperative roentgen therapy was given. The patient did not return for surgery until eight months later. At that time the pyelographic appearance was compatible with the presence of a large

Fig. 23. Bilateral perinephritic abscess.

simple cyst of the middle and lower poles of the kidney. There was an irregular globular tumor at the lower pole of the kidney; the middle and lower groups of calyces were narrowed and elongated, with a crescentic deformity. The upper third of the ureter was slightly displaced medially. Right nephrectomy was performed, and the surgical pathological diagnosis was hypernephroma.

Extrarenal lesions may also be confusing. In one instance (Fig. 23), a dense shadow was present at the lower pole of each kidney; the excretory urogram revealed a pressure defect in the lower border of each renal pelvis; and the middle and lower calyces were compressed and displaced upward. The upper third of each ureter was displaced medially. The clinical diagnosis was bilateral perinephritic abscess, and this was confirmed by surgical drainage of a large amount of pus. The urographic findings seemed suggestive of bilateral simple cysts of large size.

Another extrarenal lesion, a paravertebral abscess associated with an early tuberculosis of the spine produced a large shadow (Fig. 24) at the lower pole of the left kidney which appeared to be separate from the kidney. The middle and lower calyces, particularly the latter, were displaced laterally and upward. The renal pelvis was elongated and displaced medially. The left kidney was displaced upward, and its lower pole was displaced laterally. The clue to the diagnosis was the narrow third intervertebral disc; the narrowing progressed, the margins of the vertebral bodies became eroded, and it soon became evident that the patient had a tuberculous spondylitis with large psoas abscess.

THE POSTMORTEM GROUP

In the period from 1944 to 1948 inclusive, simple serous cysts of the kidneys were found at necropsy in 15 patients; in that period there were 897 postmortem examinations, giving an incidence of 1.67 per hundred. In none had the existence of the cysts been suspected clinically, but most of these patients were admitted to the hospital for the treatment of a severe terminal illness. In 4 patients of this group, there was a large single cortical serous cyst; in 2 there were multiple small cortical cysts in addition to a large simple cyst;

Fig. 24. Psoas abscess, tuberculous, left.

and another patient had a single cyst only 2.5 cm. in diameter. Eight patients had multiple small cysts, some of which were subcapsular. There was an associated calculous pyelonephritis in 3 of this group.

The age distribution in the postmortem group is interesting, and leads me to the conclusion that in many individuals the development of simple serous cysts of the kidneys, like the development of degenerative joint disease and diverticulosis of the colon, is part of the senescent degenerative process. The youngest of these patients was fifty-nine; the oldest, eighty-eight; and the average age was seventy-three. The type of cyst bore no relationship to the age of the patient, the range being about the same in each variety. There appeared to be no significant sex difference; distribution between males and females was nearly equal.

In the same period, necropsy revealed 2 cases of polycystic disease of the kidneys, one a woman of seventy-three, the other a man of sixty-six. There was a hemorrhagic cyst as well as several retention cysts in the left kidney of a woman, aged ninety-two, in whose right kidney two large serous cysts were found. Two patients, one a man of sixty-nine and the other a woman of fifty, had multilocular cysts and the left kidney was involved in each.

DISCUSSION

In the primary roentgenogram of the abdomen large simple cysts may appear as poorly defined masses, but often are visualized as definite tumor shadows. The urogram or pyelogram reveals evidence of pressure upon the calyces or traction on one pole of the kidney. There is seldom inclusion of the calyces in the tumor substance in the manner seen in multilocular cyst or hypernephroma. Though the kidney may be slightly rotated on its long axis, this change is seldom pronounced. Renal pelvic deformity is minimal and displacement of the ureter is slight.

Our series of 2 cases of hemorrhagic cyst does not justify far-reaching conclusions. Neither patient gave a history of trauma, and there was no evidence of malignant neoplasia. In one, generally accepted evidence of a normal urinary tract about ten months before the demonstration of a hemorrhagic cyst indicated that the lesion developed as such, rather than that hemorrhage occurred in a pre-existing, simple cyst. The pyelographic findings were similar to those of simple cysts; and roentgenographic differential diagnosis was not possible.

The pyelographic findings in our cases of multilocular cyst of the kidney were distinctive, and resembled those of hypernephroma rather than simple cyst. The calyces appeared to be included in, rather than pressed upon by the tumor. Distortion of calyces and pelvis was much greater than in simple cyst; and renal displacement was much more pronounced.

The roentgenographic manifestations of polycystic disease of the kidneys have often been described, and are quite distinctive. The calyces and pelvis of each kidney are usually dilated, elongated and greatly distorted; they have a sprawled-out appearance; and the minor calyces are often crescentic. The kidney outlines are often indistinct in the preliminary film and, when visualized, are very large. Though unilateral polycystic disease has been described, the changes are almost always bilateral; and this is one of the important points in differential diagnosis. Variation from the normal axis of the kidney, if present, is relatively slight; but the upper third or half of the ureter is often displaced medially.

Simple serous cysts of the kidney may, if in the lower pole, be differentiated from extrarenal masses by the absence of renal displacement and the demonstration of elongation of the lower calyces and compression of the upper and middle calyces in the case of renal cysts. Extrarenal tumors at the lower pole are much more likely to produce recognizable upward displacement of the kidney and compression of the lower calyces.

It is often difficult if not impossible to distinguish renal cysts from hypernephroma. We were so sure of the diagnosis of hypernephroma in one of our patients who had an hemorrhagic cyst that preoperative roentgen therapy was given. Simple serous

cysts usually exert pressure or traction upon the calyces and sometimes on the renal pelvis as well. Hypernephroma also does this but often the elongation and distortion of both major and minor calyces appears to indicate their inclusion in the tumor.

SUMMARY

The cases of cyst of the kidney studied in a large private general hospital from 1944 to 1948 inclusive have been studied. The clinical findings in these patients have been briefly noted and the roentgenographic manifestations are described in detail. A simple classification of renal cysts as we have observed them is given:

I. Congenital Cysts
  A. Polycystic disease of the kidneys
    1. Unilateral
    2. Bilateral
II. Acquired Cysts
  A. Simple serous
    1. Large "solitary"—may be multiple
      a. No connection with pelvis or calyces
      b. Pyelogenic
    2. Calycine
  B. Hemorrhagic
    1. Spontaneous
    2. Traumatic
    3. With malignant disease
  C. Multilocular
  D. Retention (small cysts of chronic sclerosing renal disease)
  E. Secondary to other renal pathological changes
    1. Infectious
    2. Neoplastic

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REFERENCES

1. BELL, E. T., Editor. A Text-Book of Pathology. Second edition. Lea & Febiger, Philadelphia, 1934, pp. 362–363.
2. BOBBITT, R. M. Secondary pathological changes in polycystic kidney disease. *J. Urol.*, 1943, *50*, 131–140.
3. BOCKUS, H. L., KROHN, S. E., and MULLEN, E. A. Solitary cyst of kidney. *Urol & Cutan. Rev.*, 1940, *44*, 448–450.
4. BRAASCH, W. F. Urography. W. B. Saunders Company, Philadelphia, 1927, pp. 339–348.
5. BRAASCH, W. F., and HENDRICK, J. A. Renal cysts, simple and otherwise. *J. Urol.*, 1944, *51*, 1–10.
6. BRAASCH, W. F., and SCHACHT, F. W. Pathological and clinical data concerning polycystic kidney. *Surg., Gynec. & Obst.*, 1933, *57*, 467–475.
7. BRANHAM, D. W. Solitary polycystic kidney and successful pregnancy. *J. Urol.*, 1947, *57*, 519–520.
8. BURRELL, N. L. Multilocular cysts of kidney. *J. Urol.*, 1940, *43*, 656–663.
9. CARLSON, H. E. Polycystic disease in solitary kidney. *J. Urol.*, 1946, *55*, 443–444.
10. FABRICIUS DE HILDEN. Quoted by Gutierrez.[15]
11. FARRELL, J. I., and YOUNG, R. H. Hypertension caused by unilateral renal compression. *J.A.M.A.*, 1942, *118*, 711–712.
12. FISH, G. W. Large solitary serous cysts of kidney. *J.A.M.A.*, 1939, *112*, 514–517.
13. FISTER, G. M. Simple serous cysts of kidney. *J. Urol.*, 1943, *49*, 408–414.
14. GREENBERG, B. E., BRODNEY, M. L., and ROBINS, S. A. Solitary cysts of kidney. *Am. J. Surg.*, 1934, *23*, 271–283.
15. GUTIERREZ, R. Large solitary cysts of kidney. *Arch. Surg.*, 1942, *44*, 279–318; correction, 1942, *44*, 598.
16. HERMAN, L., and STRUMIA, M. Primary hemorrhagic cysts of kidney. *Tr. Am. A. Genito-Urin. Surgeons (1940)*, 1941, *33*, 11–23.
17. KERR, H. D., and GILLIES, C. L. The Urinary Tract: A Handbook of Roentgen Diagnosis. The Year Book Publishers, Inc., Chicago, 1944, pp. 46–49.
18. KREUTZMANN, H. A. R. Hypertension associated with solitary renal cyst. *J. Urol.*, 1947, *57*, 467–472.
19. LIEBERTHAL, F. Multi-locular solitary cyst of renal hilus. *J. Urol.*, 1939, *42*, 321–325.
20. LOWSLEY, O. S., and CURTIS, M. S. Surgical aspects of cystic disease of kidney. *J.A.M.A.*, 1945, *127*, 1112–1119.
21. MELAND, E. L., and BRAASCH, W. F. Multilocular cysts of kidney. *J. Urol.*, 1933, *29*, 505–519.
22. MOSS, T. C. Cysts of kidneys. *Urol. & Cutan. Rev.*, 1943, *47*, 142–147.
23. MUNGER. Quoted by Bockus.[3]
24. NOLAN, L. E. Congenital polycystic disease of kidneys. *Urol. & Cutan. Rev.*, 1945, *49*, 734–737.
25. PEARCE, A. E., BOWER, J. O., and BURNS, J. C. Uncomplicated, solitary, serous renal cyst with hypertension relieved by nephrocystectomy. *Ann. Int. Med.*, 1944, *20*, 994–998.
26. PEIRSON, E. L., and DIXEY, G. M. Simple cysts of kidney. *Urol. & Cutan. Rev.*, 1941, *45*, 309–314.
27. QUINBY, W. C., and BRIGHT, E. F. Solitary renal cysts. *J. Urol.*, 1935, *33*, 201–214.

28. Robinson, L. J., and Wilder, W. O. Simple solitary renal cyst. *J. Urol.*, 1938, *40*, 10–14.
29. Scholl, A. J. Hemorrhagic cysts of kidney, with report of case. *J. Urol.*, 1939, *41*, 103–110.
30. Spencer, H. R. Congenital polycystic disease of kidneys. *South. M. J.*, 1937, *30*, 524–527.
31. Stirling, W. C. Large solitary hemorrhagic renal cyst with review of literature. *J. Urol.*, 1931, *25*, 213–222.
32. Walters, W., and Braasch, W. F. Surgical aspects of polycystic kidney. *Surg., Gynec. & Obst.*, 1934, *58*, 647–650.
33. Waterson, A. P., and Morgan, P. R. Congenital polycystic disease of liver and kidneys. *Brit. M. J.*, 1946, *1*, 609.
34. Willis, T. Quoted by Gutierrez.[15]

DISCUSSION

Dr. H. Dabney Kerr, Iowa City, Iowa. There are many things which can be confusing in diagnosis of renal conditions, and among these are the calycine diverticula or calycine cysts of which Dr. Ochsner has spoken, and the simple cyst and the hemorrhagic cysts which he has emphasized. We may be misled when we see on a retrograde pyelogram a calycine cyst and be led to believe that we are dealing perhaps with tuberculosis. That finding is not unusual and has been emphasized by other authors.

It is important, also, I think to remember that small calculi which lie in the substance of the kidney, particularly in the upper pole, may be within a calycine cyst. This has also been pointed out by Dr. Ochsner and I just want to re-emphasize it. We sometimes think that perhaps we are dealing only with small calculi in the renal substance but we may be dealing, and frequently are, with the cystic conditions or diverticulous conditions of the pelvis.

One of the most important things, I think, which should be emphasized regarding these larger cysts, and one which perhaps in his discussion Dr. Ochsner didn't emphasize quite enough, is the connection between the serous cyst which, as he pointed out, occurs in the elderly and the fact that our renal neoplasms, particularly of the hypernephroma group, occur also in that age group.

It is practically impossible to tell with certainty whether one is dealing with a simple cyst or with a cystic type or smoothly outlined renal neoplasm. Dr. Ochsner emphasized that in one instance they misdiagnosed such a case and gave the patient radiation therapy on the basis that this lesion was a malignant lesion. I think that is always a possibllity and we work on the assumption that if there is any question regarding the identity of a mass in the kidney, whether or not it is a simple cyst or whether or not it might be a neoplasm, it must be considered as a surgical problem and the patient explored and almost certainly that kidney removed.

ROENTGENOGRAPHIC STUDY OF SOFT TISSUE PATHOLOGY IN AND ABOUT THE KNEE JOINT

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Hospital for Special Surgery
NEW YORK, NEW YORK

IN RECENT years, numerous articles have appeared in the medical literature advocating study of joints by injection of contrast media, and giving findings from such studies. By explicit statement or by implication, the idea is conveyed that little or no information about the soft tissues of joints can be obtained roentgenographically except through use of this method.

Despite this rather prevalent idea, the fact remains that, with few exceptions, all the information afforded by these rather difficult, time-consuming, and costly methods is contained in ordinary routine roentgenograms, if one will but extract this information from them.

The requirements for extracting this information are two: (1) a spotlight of 100 watts, for study of the soft tissues in films of density too great for the light of the ordinary viewing box; (2) a knowledge of the roentgenologic anatomy and pathology of the joint.

For many years in this hospital it has been the routine practice of the Roentgen Department to report on the soft tissues of joints, as well as on the bones and cartilages. No special technique is used in taking the films, and a spotlight is used in studying most of them.

The purpose of this paper is to depict something of the soft tissue anatomy and pathology of the knee joint, one of the joints most accessible to roentgenographic study (see Fig. 1 to 26).

SUMMARY

1. Most of the information afforded by studies of joints after injection of contrast media can be derived from routine roentgenograms of these joints.

2. Requirements for extracting this information from routine roentgenograms are (1) a spotlight of 100 watts, and (2) knowledge of the roentgenologic anatomy and pathology of the joint.

3. The roentgenologic anatomy of the knee joint, and a number of examples of its pathology, have been shown and discussed.

The author wishes to express his gratitude to Mrs. Olive Fischer for the excellent drawings and illustrations in this article.

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REFERENCES

1. BACHMAN, A. L. Roentgen diagnosis of knee-joint effusion. *Radiology*, 1946, *46*, 462–469.
2. LEWIS, R. W. Roentgen recognition of synovioma. AM. J. ROENTGENOL. & RAD. THERAPY, 1940, *44*, 170–174.
3. LEWIS, R. W. Differential diagnosis of tuberculosis in joints of extremities. AM. J. ROENTGENOL. & RAD. THERAPY, 1945, *54*, 329–337.
4. LEWIS, R. W. Roentgen diagnosis of pigmented villonodular synovitis and synovial sarcoma of knee joint; preliminary report. *Radiology*, 1947, *49*, 26–38.

FIG. 1. *Normal Knee.* In order to recognize the abnormal, complete familiarity with the normal soft tissue roentgen anatomy is necessary. In every case, the structures shown in the above diagram should be carefully studied, using a spotlight to bring out sharp detail. The synovial membranes are seen as a narrow band just below the femoral condyles, passing forward and upward between the femur and patella. Just above the upper border of the patella, this narrow band is thrown into sharp relief by a small mass of areolar tissue below and in front, and a much larger mass of areolar tissue above and behind. Above this point the membranes lie close to the back of the quadriceps tendon, from which they cannot be distinguished. For more complete discussion, see reference 1.

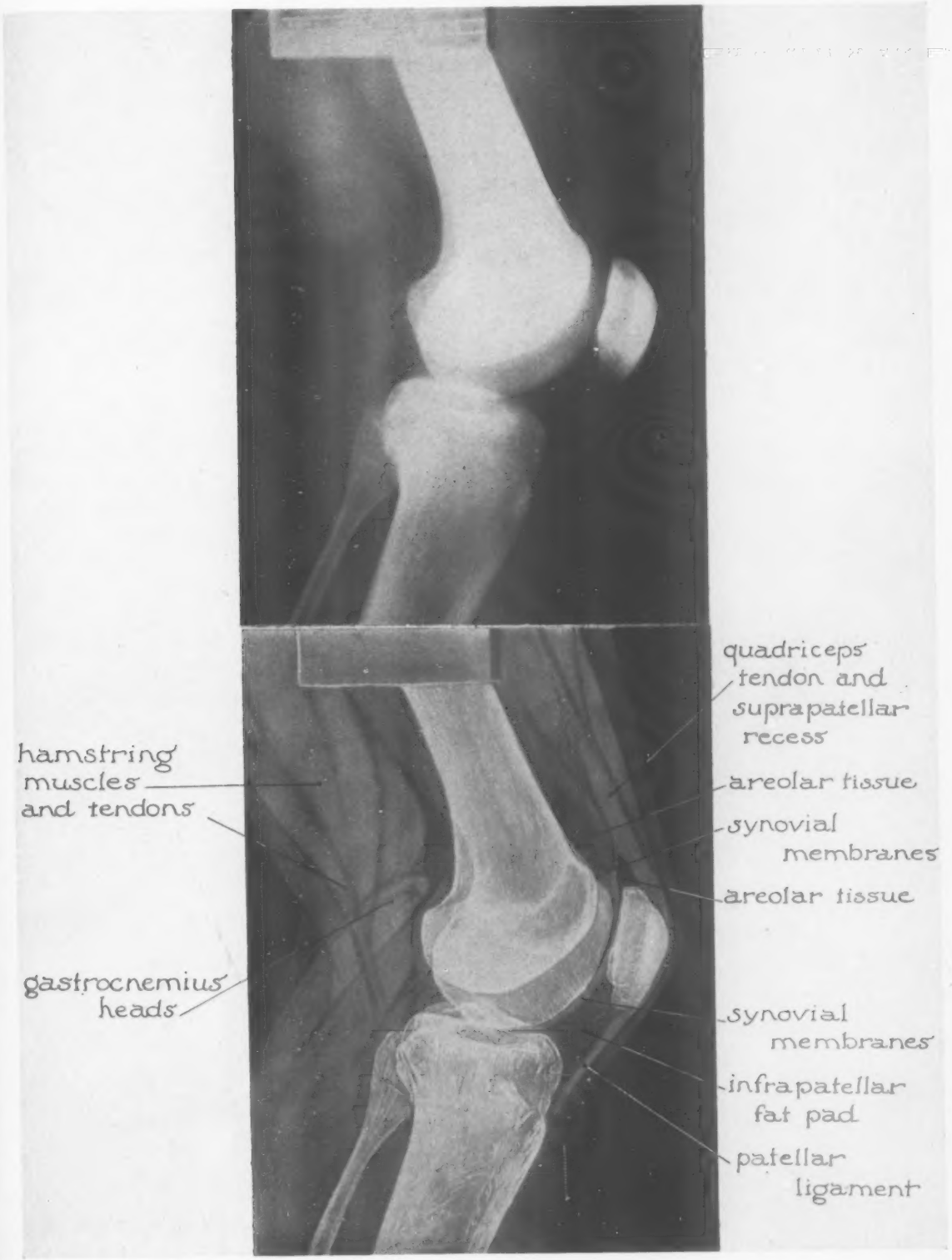
quadriceps tendon and suprapatellar recess
areolar tissue
synovial membranes
areolar tissue
hamstring muscles and tendons
gastrocnemius heads
synovial membranes
infrapatellar fat pad
patellar ligament

Fig. 1

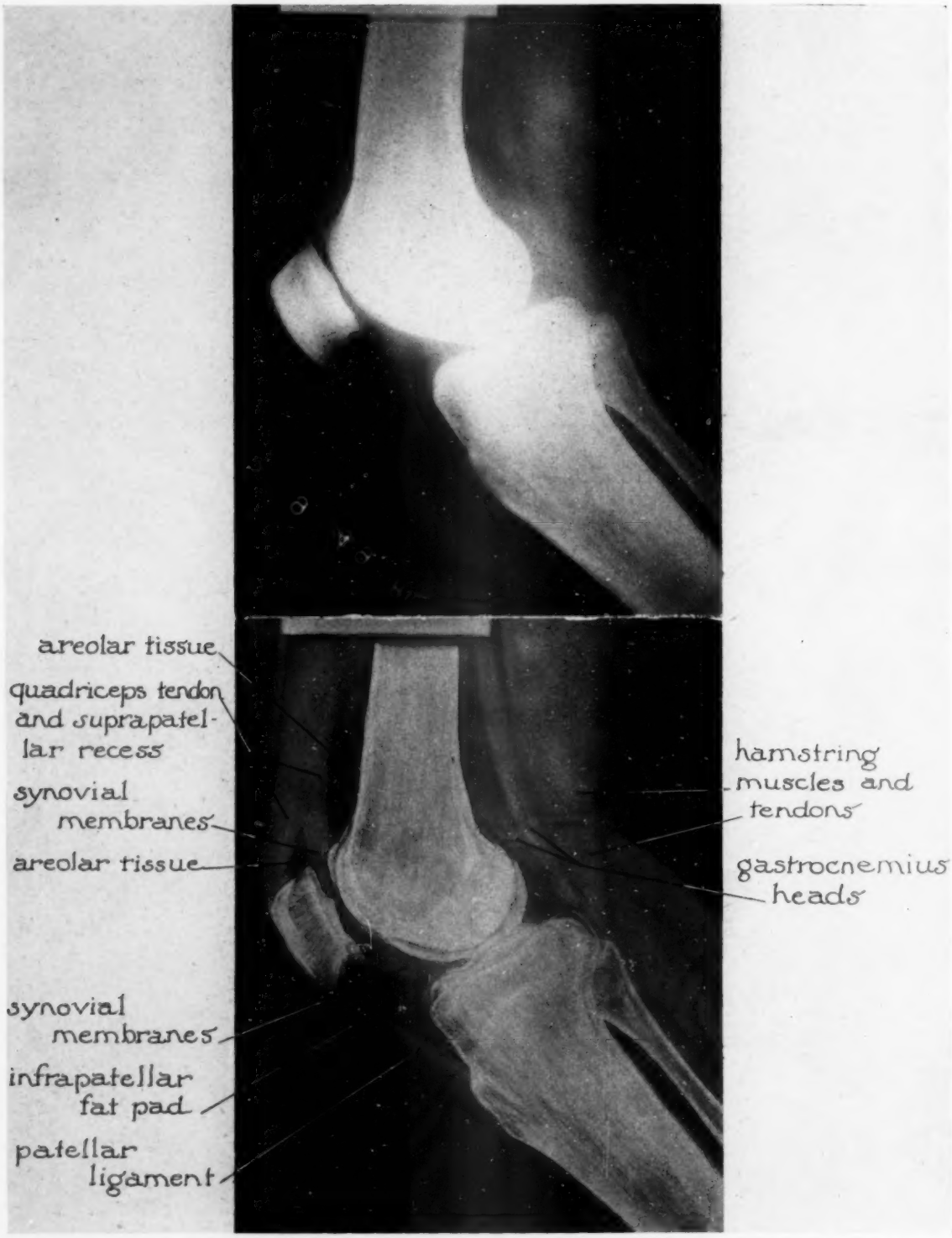

FIG. 2. *Synovitis, Slight Degree.* The shadow of the synovial membranes below the femoral condyles is widened, and it is broadened considerably where it lies between the two masses of areolar tissue just above the patella.

Fig. 3. *Synovitis, Moderate Degree.* A pyriform shadow between the quadriceps tendon and femur represents the distended suprapatellar recess of the joint. This encroaches upon the two fat masses, reducing them in size. There is widening of the shadow of the synovial membranes below the femoral condyles.

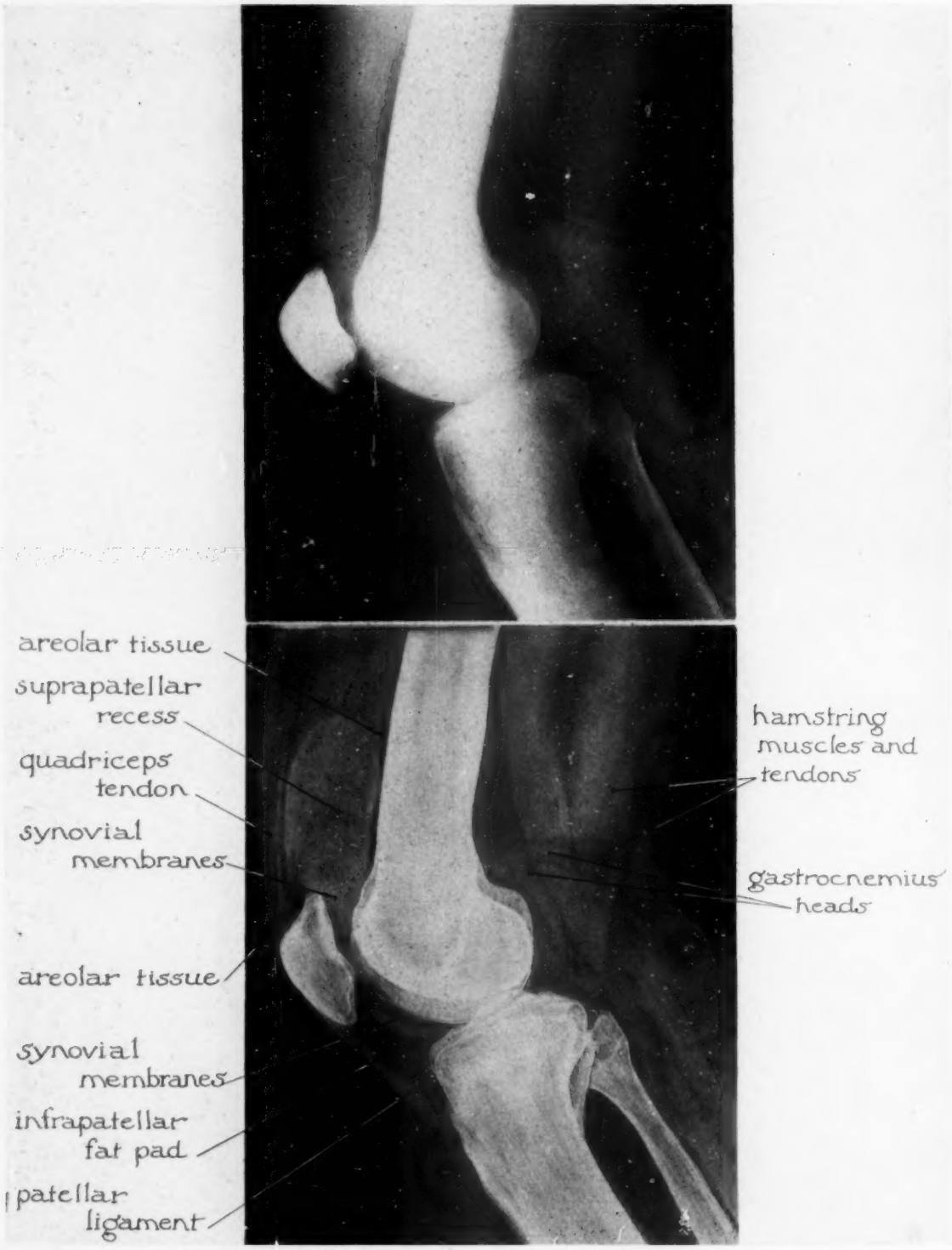

FIG. 4. *Synovitis, Marked Degree.* Further enlargement of the pyriform shadow. In severe synovitis, the distended infrapatellar portion of the joint compresses the infrapatellar fat pad, accentuating its fibrous markings. And frequently there is forward bulging of the patellar ligament. Not infrequently the presence of a thin layer of fat against the posterior capsule delineates backward bulging of this structure. For more complete discussion of synovitis, see reference 1.

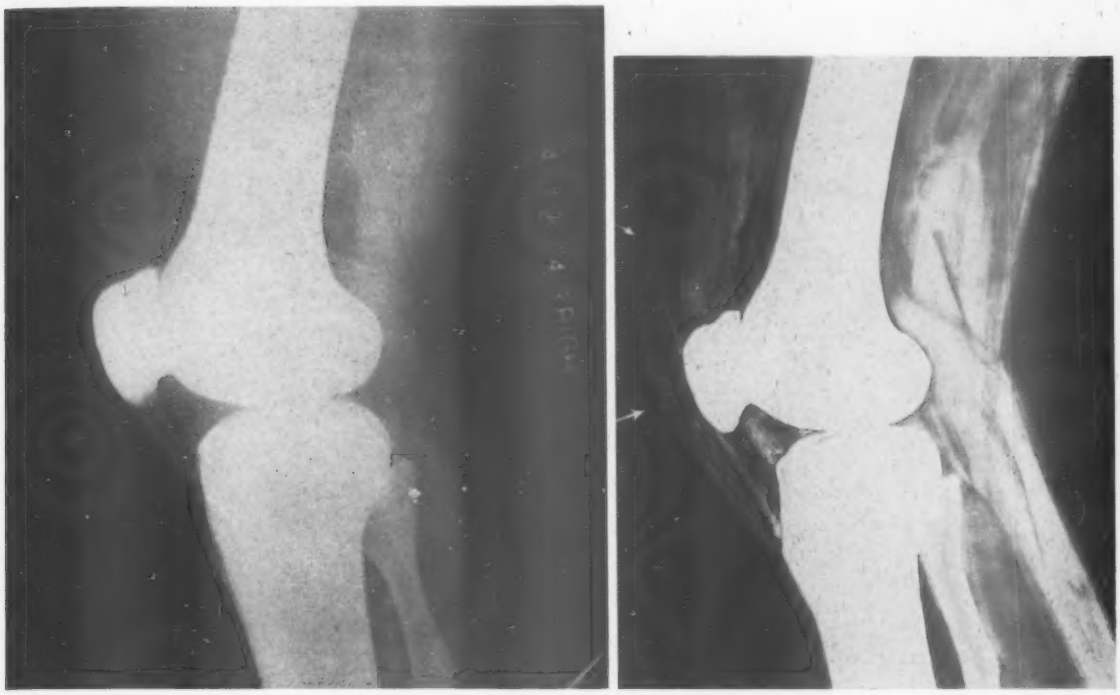

Fig. 5. *Cellulitis Outside Joint.* The clinical diagnosis was acute suppurative arthritis. The correct diagnosis of extra-articular cellulitis was made on the roentgenographic findings of subcutaneous edema anterior to the quadriceps tendon, patella, and patellar ligament, with little or no synovitis.

Fig. 6. *Prepatellar Bursitis.* Circumscribed soft tissue swelling anterior to the patella, with no evidence of abnormality of the patella or of the synovial membranes. In prepatellar contusion, the changes are more diffuse.

FIG. 7. *Cyst of Lateral Meniscus.* Localized rounded soft tissue swelling placed symmetrically across the lateral aspect of the knee joint. Distinguished from generalized synovitis by absence of a similar swelling medially. When a moderate degree of synovitis accompanies this condition, the cyst may be suspected by the disproportionately large swelling laterally.

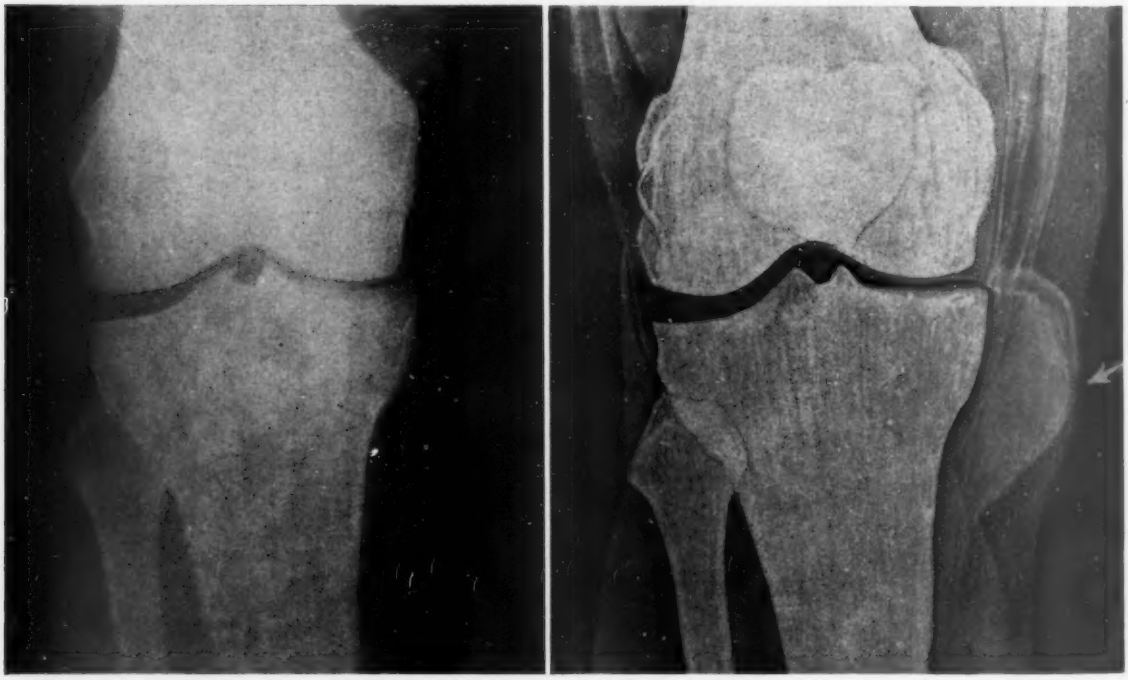

FIG. 8. *Bursitis Outside Joint.* Localized rounded soft tissue swelling near the area of insertion of the three tendons medially in the upper tibial shaft. Can be distinguished from cyst of the meniscus by its asymmetrical relation to the joint.

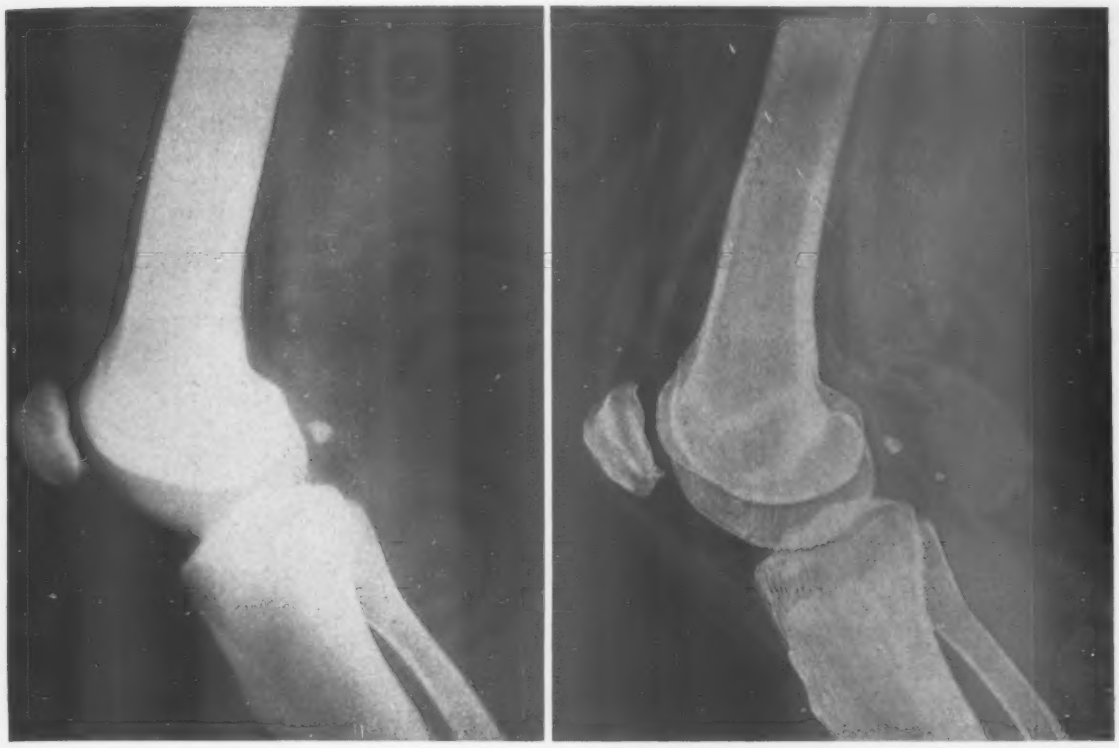

FIG. 9. *Popliteal Cyst.* Sharply defined oval soft tissue swelling behind the joint. Often largely obscured by the shadows of the gastrocnemius heads and hamstring tendons, from which it must be differentiated. When it communicates with the joint, there may be an associated synovitis of slight degree.

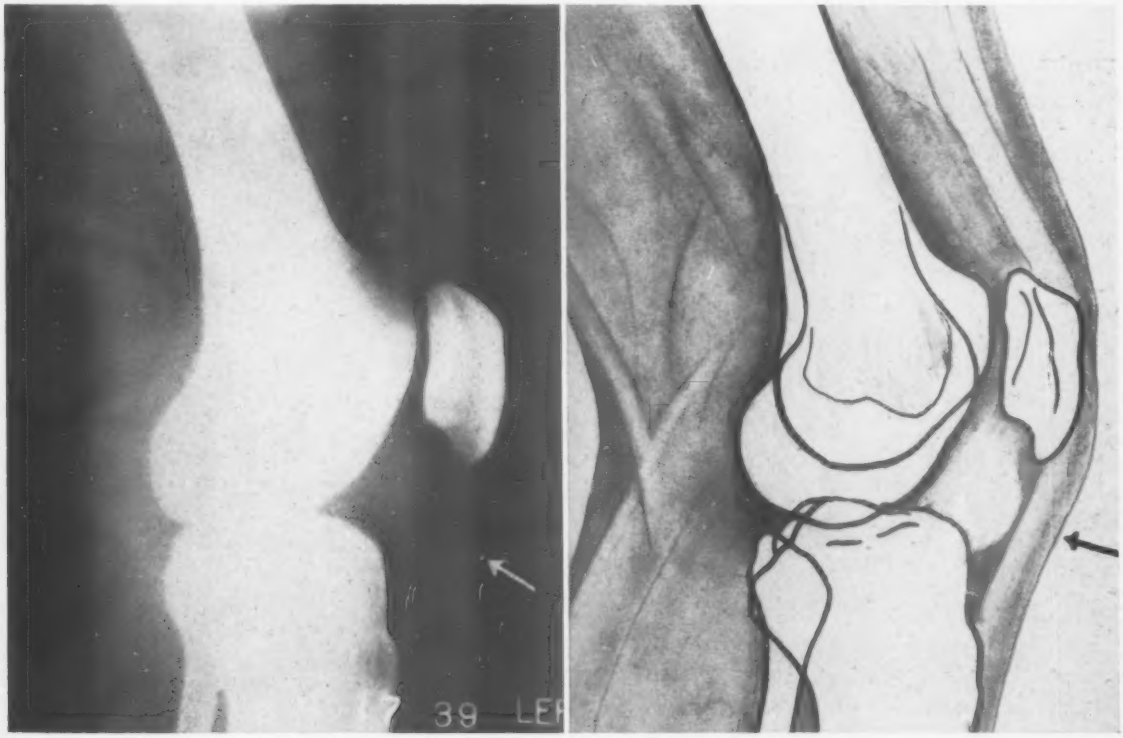

FIG. 10. *Cyst of Infrapatellar Fat Pad.* Sharply defined soft tissue mass in the region of the infrapatellar fat pad. No evidence of abnormality of the bones, cartilages, or synovial membranes. No diagnosis more precise than lesion of the fat pad can be made. Diagnosis by pathologist: benign fibrocartilaginous cyst of the fat pad.

FIG. 11. *Bursa of Infrapatellar Fat Pad.* Dense homogeneous soft tissue mass in the region of the infrapatellar fat pad, filling this space and causing forward bulging of the patellar ligament. Probably a slight amount of free fluid in the joint. Evidences of moderate degenerative arthritis. Roentgen diagnosis: lesion of the infrapatellar fat pad. Pathologist's diagnosis: chronic degenerative and productive bursitis of the fat pad.

FIG. 12. *Rheumatoid Arthritis.* Generalized homogeneous osteoporosis, soft tissue atrophy, slight degree of synovitis, slight thinning of cartilages, small erosions of articular surfaces. Usually easily recognizable when multiple joints are involved. When monarticular, in the early stages frequently indistinguishable from tuberculosis. Usually the joint space narrows earlier in rheumatoid arthritis. The tuberculin test is helpful in children. In time, the course of the disease establishes the diagnosis.

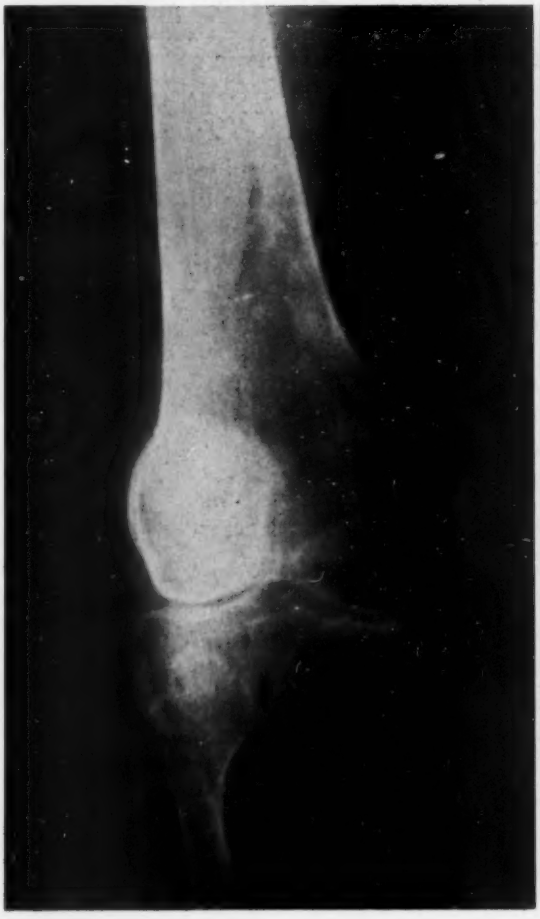

Fig. 13. *Tuberculosis, Early.* Severe synovitis, good preservation of joint width, bone erosion at margins of articular surfaces, atrophy of adjacent muscles of thigh and leg. The distinctive features are: good preservation of joint width and bone erosion at the margins of the articular surfaces. It is wise to judge the joint width in the lateral projections rather than in the anteroposterior view. In the latter there is distortion because the synovitis prevents full extension of the joint. For more complete discussion see reference 3.

Fig. 14. *Non-tuberculous Infection.* The clinical diagnosis was tuberculosis. The correct diagnosis of non-tuberculous infection was made roentgenographically, because of diminution of the joint width, and bone erosion on the central weight-bearing portions of the articular surfaces. These are characteristics of non-tuberculous infection. Compare with preceding case (Fig. 13).

Fig. 15. *Hemophilia.* Synovitis, thinning of cartilages, osteoporosis, slight erosion of articular surfaces. Can be recognized roentgenologically as chronic arthritis of some type, but the precise diagnosis can be made only with the aid of the history.

FIG. 16. *Pigmented Villonodular Synovitis.* Tremendous degree of synovitis in a young person, in this case nodular in pattern, but this is not always so. No suggestion of bone or cartilage abnormality, not even osteoporosis. Can be recognized as belonging in the group comprising villonodular synovitis and synovial sarcoma (synovioma). Precise diagnosis is dependent on pathologic findings on biopsy material. For more complete discussion, see reference 4.

Fig. 17. *Synovial Sarcoma.* In this case, indistinguishable from pigmented villonodular synovitis. See discussion of preceding case (Fig. 16).

FIG. 18. *Synovial Sarcoma.* Distinguishable from pigmented villonodular synovitis because of invasion and erosion of adjacent bone, femur. Villonodular synovitis may sometimes send finger-like processes through openings into the substance of bone, but it never produces gross erosion and destruction of bone.

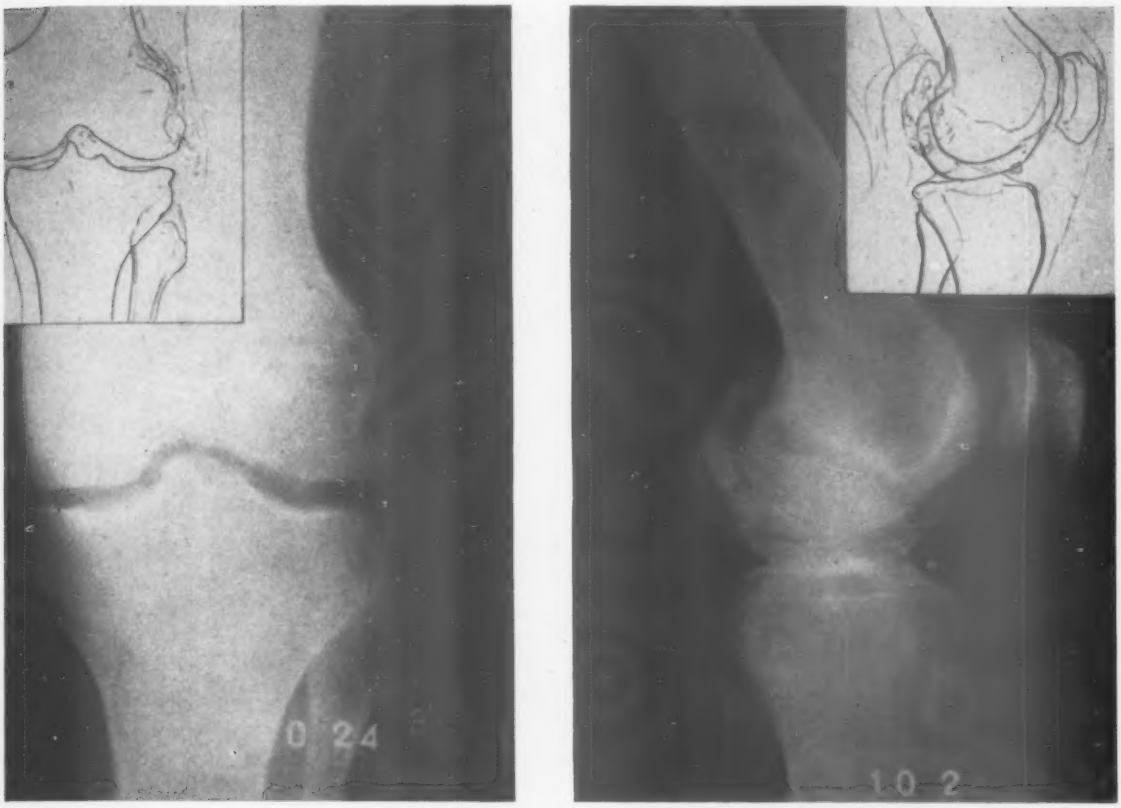

FIG. 19. *Synovial Sarcoma.* Distinguishable because in the rather lobulated soft tissue mass there are scattered and irregular deposits of amorphous lime. For more complete discussion, see reference 2.

Fig. 20. *Synovial Sarcoma.* Small synovioma, suspected because of flecks of lime in a soft tissue mass lateral to the lower extremity of the femur. Calcifying peritendonitis was ruled out by histopathologic study of biopsy material, which confirmed the diagnosis of synovial sarcoma. See reference 2.

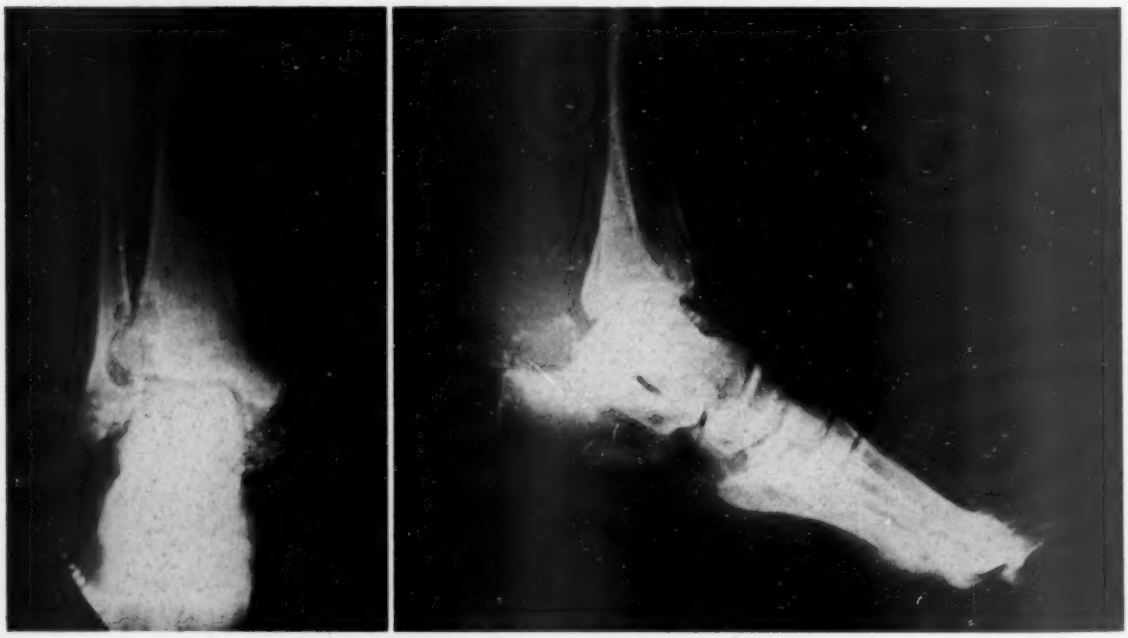

Fig. 21. *Chondroma Presenting Characteristics of Synovial Sarcoma.* Note the lobulated soft tissue mass containing scattered and irregular deposits of amorphous lime. Note the similarity to the two preceding cases. Mistaken by roentgenologist for synovial sarcoma. The hardness of the mass would be a distinguishing feature clinically. The pathologist's report from two biopsies was chondroma.

FIG. 22. *Synovial Sarcoma, Popliteal.* The symptoms were continuous pain, unrelieved by conservative therapy, and inability to extend knee fully. In the popliteal space a rather vague soft tissue mass, not conforming to any normal structures, was seen. This, with the symptoms, was indication for operation. Microscopic study of removed tissue: synovial sarcoma.

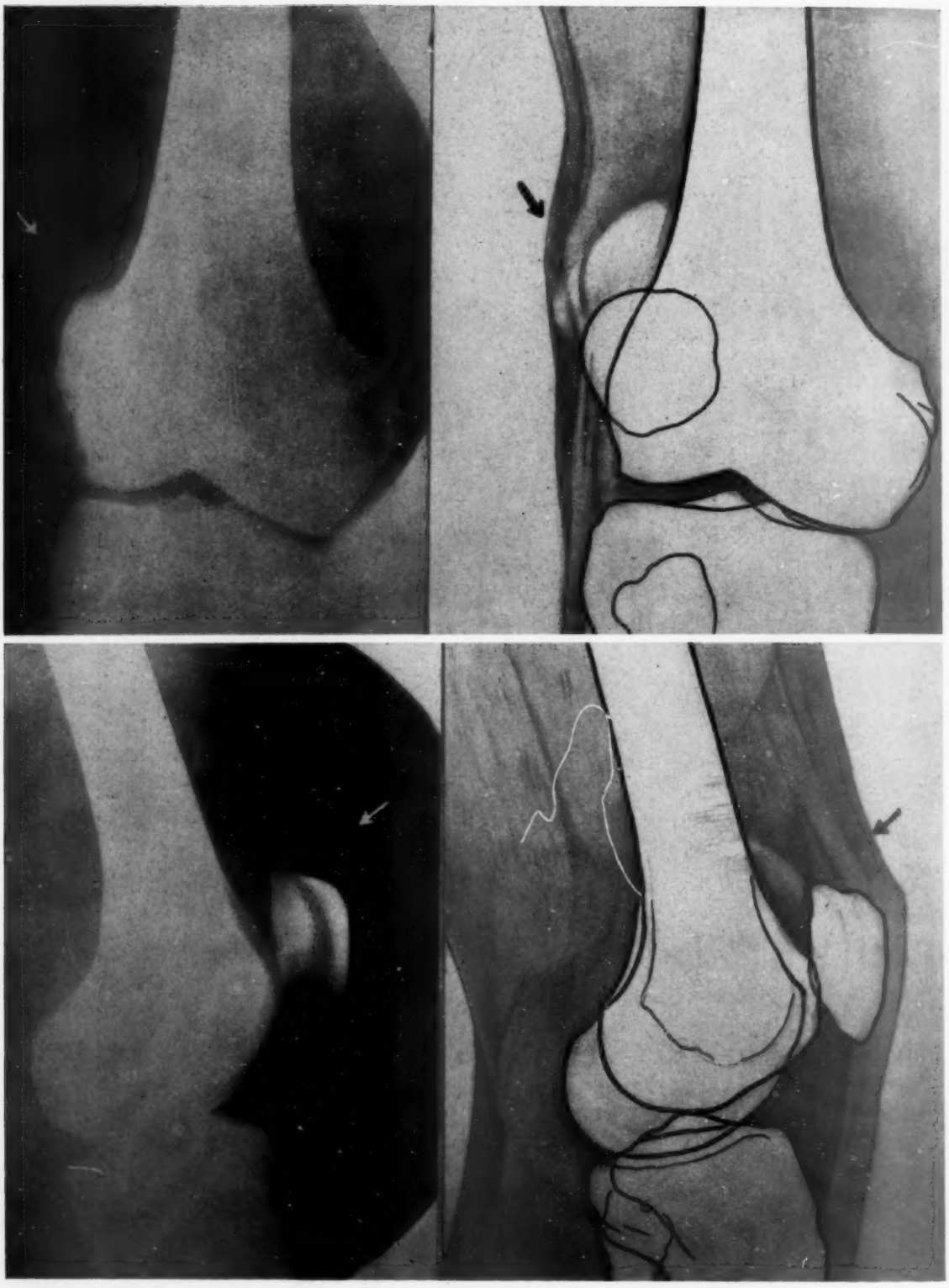

FIG. 23. *Angioma in Knee Joint.* Sharply circumscribed soft tissue mass within the knee joint. Precise diagnosis was not possible roentgenographically, but was established by the pathologist.

Fig. 24. *Ruptured Quadriceps Tendon.* Much subcutaneous swelling and edema anterior to the knee joint, with maximum in the suprapatellar region. Small amount of exudate in the suprapatellar recess of the joint. The quadriceps tendon is not visible just above the patella. Its distal termination, somewhat above the patella, is marked by a small bony body, presumably torn from the patella. There is a relaxation of the patellar ligament. The findings are characteristic, and the condition can be diagnosed roentgenologically, even in the absence of avulsion fracture of the patella.

Fig. 25. *Ruptured Patellar Ligament.* Exudate in and about the joint anteriorly. Gap in the patellar ligament with hiatus filled with exudate. In indirect injury cases, partial tear of the attachment of the patellar ligament may be suspected when there is swelling and edema about the distal portion of the patellar ligament and its point of attachment.

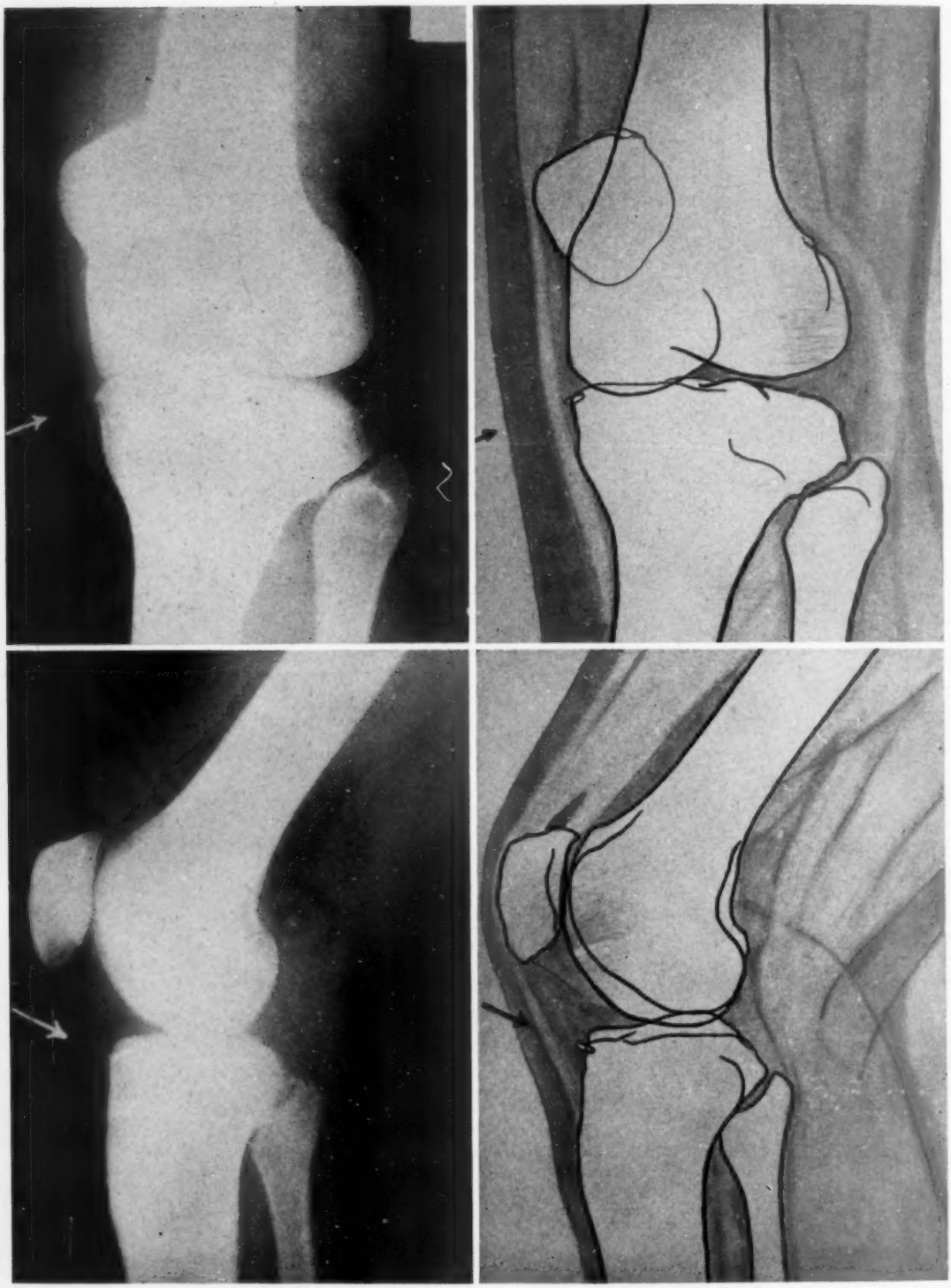

FIG. 26. *Foreign Body in the Knee Joint.* The foreign body and localized inflammatory reaction were seen in the roentgenograms. The history recorded injury by a lead pencil. Experimental roentgenograms of a pencil showed that the pencil point and foreign body had identical appearance. Operation confirmed the presence of the pencil point, plus some of the wood, which, having practically the same density as soft tissues, was not visible.

MULTICENTRIC OSTEOGENIC SARCOMA IN PAGET'S DISEASE WITH CEREBRAL EXTENSION*†

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THE coexistence of osteogenic sarcoma with Paget's disease of bone is not unusual. In persons over fifty years of age the presence of osteogenic sarcoma is considered presumptive evidence of concurrent Paget's disease by Kolodny.[7] Sarcoma of the skull is relatively rare, having been found in only 8 of 208 cases of Paget's disease reviewed by Kirshbaum,[6] an incidence of 3.8 per cent. In the same review this author found 22 cases of sarcoma involving other bones, and over-all incidence of 14.4 per cent. Geschickter and Copeland[4] found that in Paget's disease sarcomatous change takes place in affected bones in 5 to 7 per cent of cases. Multicentric foci of sarcoma in bones involved by Paget's disease have been reported frequently and are not usually considered metastatic.[2,5,8,9,11]

Intracranial involvement by osteogenic sarcoma in association with Paget's disease has been reported 7 times,[1,3,6,8,9,10] but cerebral extension has only been reported twice.[8,10] Wolfe and Black[12] presented the first case of an intradural sarcoma in association with Paget's disease of the skull. This tumor showed no evidence of direct attachment to bone. Kirshbaum[6] reported a case of giant cell fibrosarcoma of the skull associated with Paget's disease in which the tumor compressed the left parietal lobe producing hemorrhagic encephalomalacia. The case of Manganiello *et al.*[8] was that of an osteolytic osteogenic sarcoma of the skull complicating Paget's disease with direct extension of tumor into the cerebrum. The case to be reported here probably represents the second instance of osteogenic sarcoma of the skull with cerebral extension in Paget's disease.

REPORT OF CASE

A white male, aged fifty-seven, was admitted to the New Orleans Veterans Administration Hospital on April 9, 1948. He was transferred from another hospital where he had been for one week with a fracture of the right femur. This fracture occurred when the patient slipped to the bathroom floor, sustaining only a minimal amount of trauma. He was stated to have been in good health until twenty-two years ago (1926) at which time he sustained a fracture of the left humerus, again following minimal trauma. Healing was uneventful. The patient continued without incident until four years later (1930) when he sustained another fracture of the left humerus approximately 4 inches distal to the previous fracture site. Although a bony mass was noted at that time, it was diagnosed as excess calcium deposition at the previous fracture site. Nine years following the second fracture (1939) and again following minimal trauma, the right humerus was fractured. At that time multiple roentgenograms revealed bone changes characteristic of Paget's disease. Although the bony mass persisted in the upper left arm, the patient was well and noted no untoward signs or symptoms until 1940, when he began to notice bowing of his lower extremities. In July, 1947, he again fractured his left humerus when he twisted his arm opening a door. The patient was hospitalized and a diagnosis of osteogenic sarcoma of the left humerus was made by biopsy. In September, 1947, his left arm was amputated 3 inches distal to the shoulder joint. Immediately preceding this amputation, the patient noted marked fatigue and weakness which progressed until admission to this hospital. Just prior to admis-

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† Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

** Now located at the City of Kingston Laboratory, Kingston, New York.

FIG. 1. Roentgenogram of pelvis and upper femurs showing extensive changes characteristic of Paget's disease.

sion, he was sleeping fifteen to eighteen hours a day. Two months prior to the present admission, a firm, non-tender, non-movable mass was noted over the right frontal region which enlarged rapidly to 3 inches in diameter.

Physical Examination. The patient was malnourished and chronically ill with the right lower extremity in Russell traction. He had Cheyne-Stokes respiration. In the right frontal area extending to the orbit was the previously described mass. The right lid was ptosed. The heart was slightly enlarged and peripheral vessels were sclerotic. Three inches distal to the left shoulder joint was a healed amputation stump. There was marked anterolateral bowing of the tibiae and fibulae. The fracture of the right femur was stabilized with Russell traction. Neurological examination was limited because of amputation and traction but was essentially normal. The remainder of the examination was negative.

Laboratory Examination. Red blood cell count, 3,830,000; white blood cell count, 8,200, with neutrophils 68 per cent, lymphocytes 30 per cent, monocytes 2 per cent. Kahn test was negative. Urinalysis was negative except for a slight trace of albumin and 10 to 15 pus cells per high power field. Calcium 11.8 mg., phosphorus 4.1 mg. per 100 cc. Alkaline phosphatase 9.5 Bodansky units. Total protein 5.5 gm., albumin 2.8 gm., globulin 2.7 gm. per 100 cc. non-protein nitrogen 65 mg. Roentgen examination of the chest on admission revealed normal lung fields. Views of the humeri revealed Paget's disease, more marked on the right. There was a fracture through the subtrochanteric portion of the shaft of the right femur through an area of extensive osteolysis. The remainder of the femur showed extensive Paget's disease (Fig. 1). Marked anterior bowing was noted. The roentgenological diagnosis was pathological fracture of the femur resulting from sarcomatous changes in Paget's disease.

FIG. 3. Base of skull with calvarium removed showing defects in right frontal and parietal bones with invasion of the floor of anterior fossa.

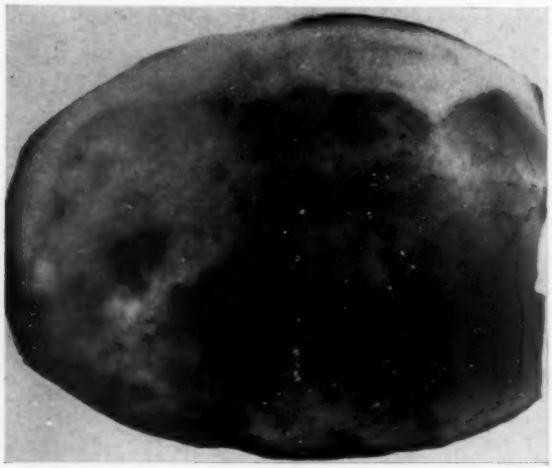

FIG. 2. Roentgenogram of removed calvarium showing Paget's disease and punched out lytic areas of tumor.

Clinical Course. The patient had a rapidly retrogressive course lasting twelve days. He developed pneumonia, became stuporous and died on April 20, 1948.

Autopsy. The body was that of a poorly nourished, poorly developed white male weighing 140 pounds, and measuring 68 inches. In the right frontal region was a firm mass meas-

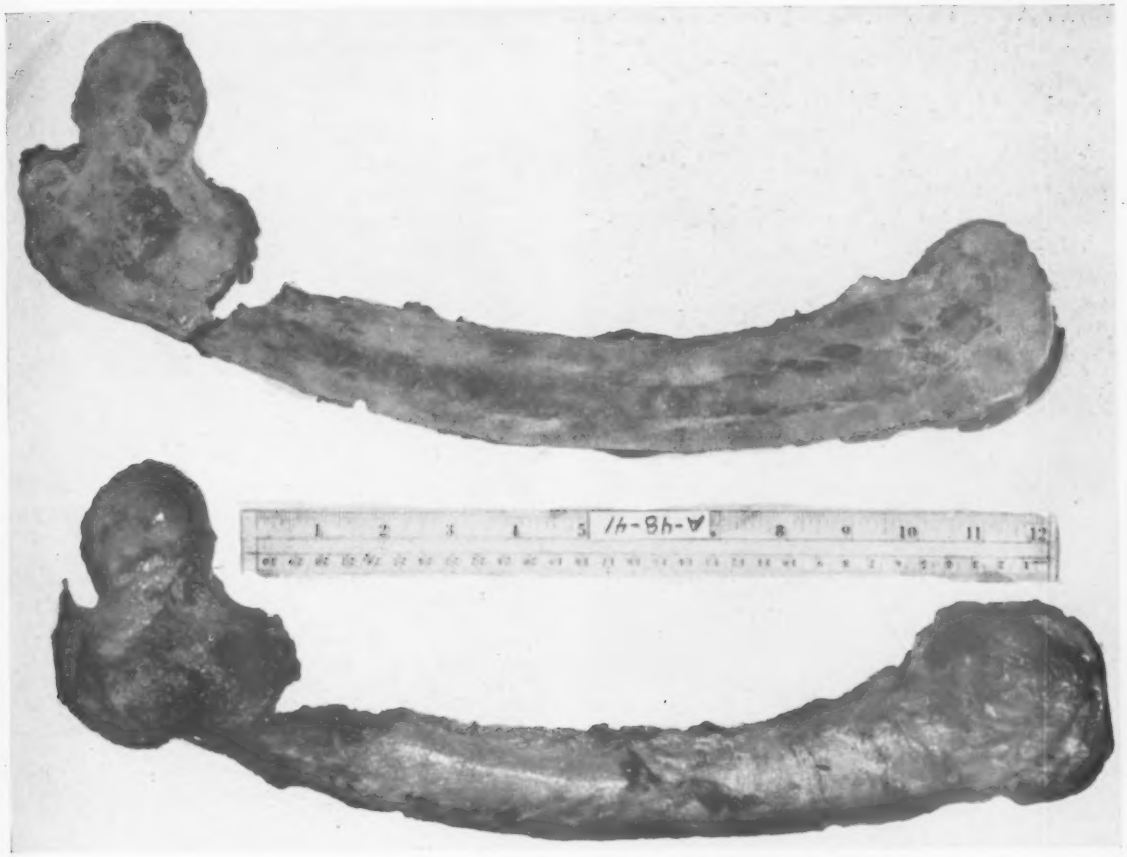

Fig. 4. Right femur revealing fracture through tumor with irregular cortical thickening and trabeculation.

uring 5 cm. in the greatest diameter. The skin over the mass was freely movable but the underlying bone appeared absent. The left arm was amputated 15 cm. below the shoulder joint. The stump was well healed. Both femurs revealed anterolateral bowing. A fracture was present in the upper third of the right femur. The right pleural cavity showed acute fibrinous pleuritis with a 50 cc. effusion. The heart weighed 380 grams. The coronary vessels were tortuous and sclerotic. The right lung weighed 780 grams. The left lung weighed 460 grams. The lungs showed patchy and confluent bronchopneumonia with a 3 cm. abscess cavity in the right lower lobe. The tracheobronchial tree was congested and filled with a thick purulent exudate. The liver weighed 1,750 grams and was congested but free of gross metastases. The spleen weighed 110 grams and was normal on gross inspection. The pancreas, adrenals and gastrointestinal tract were normal. The right kidney weighed 150 grams and the left kidney weighed 175 grams. Both revealed finely granular surfaces. The genitourinary tract showed no other changes. On reflecting the scalp, an irregular bone defect was found in the right frontal bone measuring 3 cm. in diameter, and another was found in the right parietal bone measuring 1.5 cm. in diameter. These defects were filled with soft, pink-red tumor tissue which in some places was hemorrhagic. At both sites the tumor penetrated to the subcutaneous tissues, and within the skull fused to form one mass, invading the dura and brain. The skull was irregularly thickened and spongy. In addition to the previously mentioned bone defect many punched out, tumor-filled lesions were found in the calvarium varying from 0.3 cm. to 2.0 cm. in diameter (Fig. 2). The right frontal tumor mass had invaded and destroyed the bony floor of the anterior fossa on the right side (Fig. 3). The orbit, however, was free of tumor. The right femur presented anterolateral bowing. There was a complete subtrochanteric

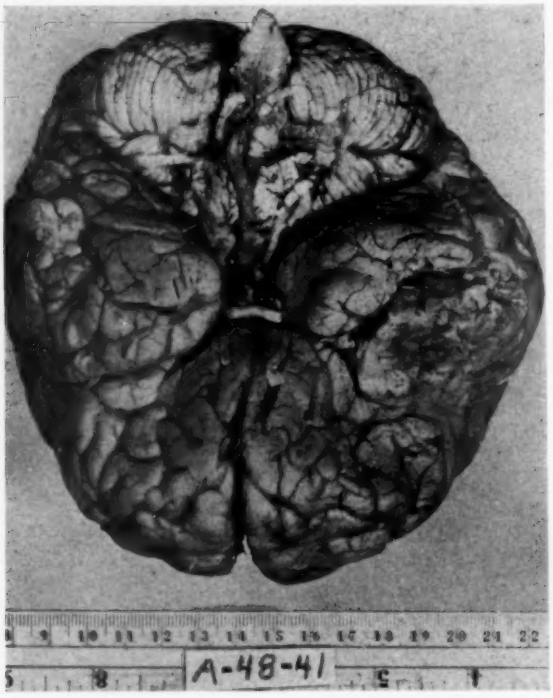

FIG. 5. Inferior surface of brain with tumor invading right temporal and frontal lobes.

fracture through an area of pink-gray, soft tumor tissue. This tumor extended for 2 cm. superiad, and for a few centimeters inferiad in the medullary cavity. The cortex of the femur was markedly and irregularly thickened with obvious coarse trabeculations most prominent at the articular ends (Fig. 4). On the external surface of the dura overlying the right frontal lobe were found three polypoid yellow-gray tumor nodules varying from 0.5 to 1.5 cm. in diameter. They were firmly attached but did not extend through the dura. However, the dura over the anterior pole of the right temporal lobe was invaded and destroyed by tumor extending medially from the side of the skull into the temporal and frontal lobes. The brain weighed 1,350 grams. The right cerebral hemisphere was larger than the left due to invasion by a tumor mass which occupied the entire anteroinferior aspect of the temporal lobe (Fig. 5). The tumor mass invaded also into the inferior surface of the right frontal lobe. There was flattening of the convolutions and narrowing of the sulci particularly in the right cerebral hemisphere. Section of the brain revealed the tumor mass to lie for the most part in the right temporal lobe with extension into the posteroinferior aspect of the right frontal lobe (Fig. 6). This mass measured 4.5 by 4.5 by 6.5 cm. The tumor was finely granular and varied from white to red-gray. The right lateral ventricle was compressed. The remainder of the brain was essentially normal.

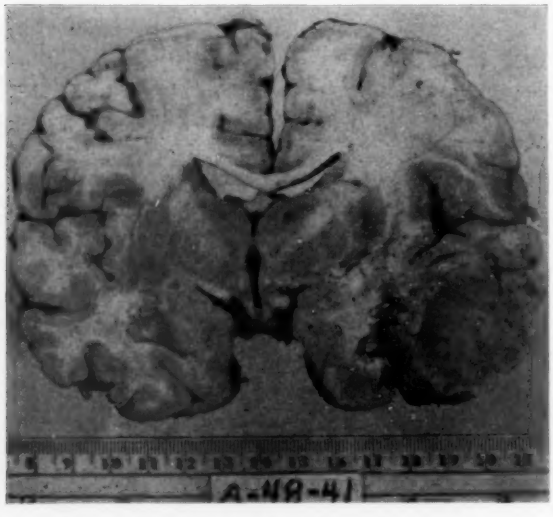

FIG. 6. Coronal section through tumor in right temporal lobe.

FIG. 7. Microscopic section from femur showing mosaic pattern of Paget's disease.

Microscopic Findings. Sections of the femur and skull revealed a definite mosaic pattern (Fig. 7). The tumor mass in the right femur was composed of spindle-shaped cells with hyperchromatic pleomorphic nuclei (Fig. 8). The nuclei contained coarse chromatin granules and large nucleoli (Fig. 9). Mitotic figures were uncommon but not rare. Blood vessels were thin walled and infrequent. Stroma was scant. Large zones of necrosis were found within the tumor

mass. No osteoid or osseous tissue was noted within the tumor. The cytology of the skull tumor was similar to that in the femur except that some areas were composed of large plump cells and occasional bizarre giant forms (Fig. 10). Here again there was no evidence of osteogenesis. Sections taken from a punched out lesion of the skull revealed tumor resembling that previously described except that the cells

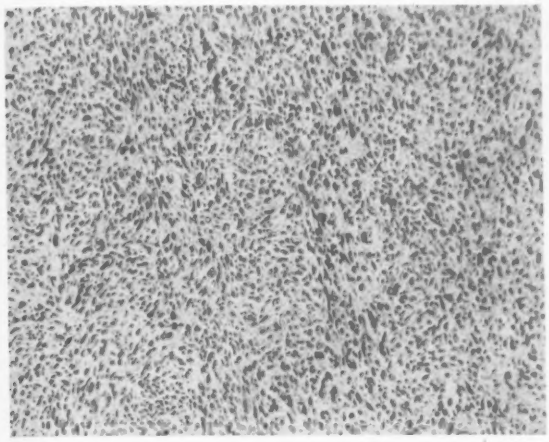

Fig. 8. Microscopic section of right femoral tumor showing spindle-shaped cells.

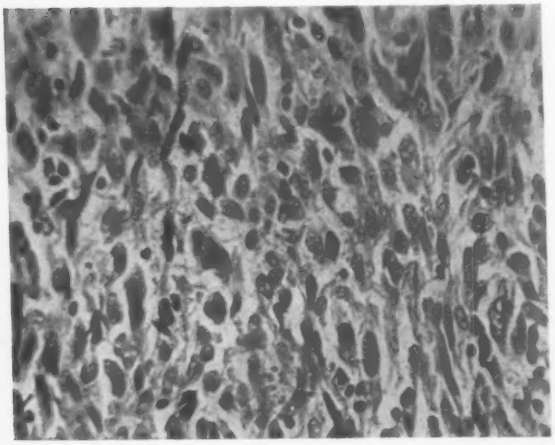

Fig. 9. High power view showing pleomorphism and absence of osteogenesis.

tended to be arranged in a more prominent but still delicate fibrous stroma. In this portion of the tumor the predominant cell was a round cell rather than a spindle cell. Multiple sections revealed tumor filling the subarachnoid space and extending into the right frontal and temporal lobes (Fig. 11). In these areas the tumor was composed of closely approximated spindle-

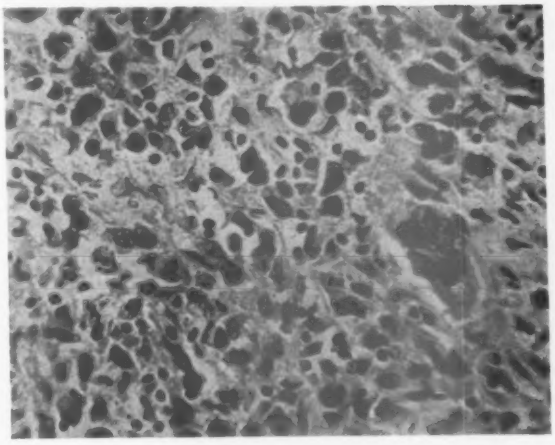

Fig. 10. Microscopic section from skull tumor showing bizarre giant and polyhedral cells.

shaped cells. The brain tissue surrounding the growth was markedly vascular and showed destruction and hemorrhage due to the presence of the tumor. Neuroglial reaction was minimal. Section of other portions of the brain revealed no pathology. The heart showed coronary sclerosis. The spleen was congested. The pancreas, gastrointestinal tract, and the adrenals exhibited only postmortem changes. Except for nephrosclerosis the genitourinary tract was normal. Multiple sections of the lungs revealed large confluent areas of bronchopneumonia with zones of liquefaction necrosis. The pleura presented an acute fibrinous exudate. The liver showed central areas of necrosis with neutrophilic infiltration.

Diagnosis. The diagnosis was Paget's disease with multicentric osteolytic osteogenic sarcoma

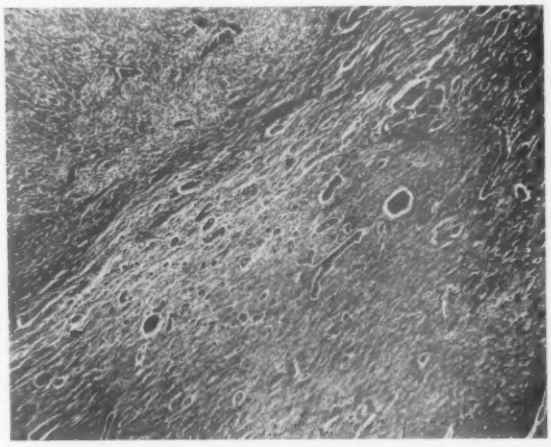

Fig. 11. Microscopic section showing tumor invading temporal lobe.

of the right femur, left humerus and skull, with extension through the dura into the right frontal and temporal lobes; bronchopneumonia with abscess, right lower lobe; purulent tracheobronchitis; left acute pleuritis with effusion; coronary sclerosis; cardiac hypertrophy; and benign nephrosclerosis.

DISCUSSION

The histopathological picture of the tumor in this case was that of an osteolytic osteogenic sarcoma. This was true for the tumor in sections from both the femur and skull. Geschickter and Copeland[4] state that sarcomas in Paget's disease are usually the periosteal type, but that they may be the chondral, osteolytic or osteoblastic varieties of osteogenic sarcoma.

The associated finding of two such uncommon diseases as osteogenic sarcoma and Paget's disease suggests more than a coincidental relationship. Coley and Sharp[2] reviewed 71 cases of osteogenic sarcoma in patients over fifty years of age in which 20 cases (28.1 per cent) revealed the tumor to be in bones affected by Paget's disease. This emphasizes the likelihood of underlying Paget's disease in osteogenic sarcoma occurring after the age of fifty. However, the data from these authors indicate that osteogenic sarcoma after the fifth decade is not necessarily related to Paget's disease. Before the age of fifty osteogenic sarcoma is practically never associated with Paget's disease.[2]

It is generally reported that Paget's disease is present for a considerable time before the onset of osteogenic sarcoma. The duration is usually considered to be from ten to fifteen years. The longest period is that of Parenti and Lüdke's[9] case which was thirty-five years. The duration of our case was at least eight years.

SUMMARY

A case of osteogenic sarcoma superimposed on Paget's disease is reported.

Multiple sarcomatous foci were found in the skull, right femur and left humerus.

The tumor extended from the skull into the cerebrum.

This is the third case of cerebral involvement by osteogenic sarcoma of the skull in Paget's disease.

Acknowledgment is hereby made to Mr. F. W. Busic and Mr. W. H. Bohon for their photographic assistance.

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REFERENCES

1. Cabot Case Record 12513. *Boston M. & S. J.*, 1926, *195*, 1215–1222.
2. COLEY, B. L., and SHARP, G. S. Paget's disease; predisposing factor to osteogenic sarcoma. *Arch. Surg.*, 1931, *23*, 918–936.
3. DAVIE, T. B., and COOKE, W. E. Supervention of osteogenic sarcoma in Paget's disease. *Brit. J. Surg.*, 1937, *25*, 299–316.
4. GESCHICKTER, C. F., and COPELAND, M. M. Tumors of Bone. Revised. American Journal of Cancer, New York, 1936, pp. 791–792.
5. JAFFE, H. L. Paget's disease of bone. *Arch. Path.*, 1933, *15*, 83–131.
6. KIRSHBAUM, J. D. Fibrosarcoma of skull in Paget's disease. *Arch. Path.*, 1943, *36*, 74–79.
7. KOLODNY, A. Bone Sarcoma: The Primary Malignant Tumors of Bone and the Giant Cell Tumor. Surgical Publishing Company, Chicago, 1927, p. 21.
8. MANGANIELLO, L. O. J., REIMANN, D. L., and WAGNER, J. A. Cerebral involvement by osteogenic sarcoma associated with Paget's disease of skull. *Arch. Neurol. & Psychiat.*, 1948, *59*, 99–106.
9. PARENTI, G. C., and LÜDEKE, H. Sarkom auf dem Boden einer Ostitis deformans Paget (Kasuistischer Beitrag). *Virchows Arch. f. path. Anat.*, 1935, *296*, 200–211.
10. REGAN, J. R. Paget's disease with secondary general osteogenic sarcoma. *M. Bull. Vet. Admin.*, 1938, *14*, 279–282.
11. VON ALBERTINI, A. Über Sarkombildung auf dem Boden der Ostitis deformans Paget. *Virchows Arch. f. path. Anat.*, 1928, *268*, 259–273.
12. WOLFE, A. M., and BLACK, W. C. Paget's disease; report of case with intracranial neoplasm. *Rocky Mountain M. J.*, 1940, *37*, 586–587.

AN UNUSUAL CASE OF CARCINOSARCOMA OF THE ESOPHAGUS*†

By NORMAN ENDE, M.D., PHILIP PIZZOLATO, M.D., LOUIS RAIDER, M.D., *and* JOSEPH ZISKIND, M.D.

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CARCINOSARCOMA of the esophagus is an extremely rare lesion. In a recent review by Saphir and Vass[4] of 153 cases of this type of malignancy in all organs of the body, only 3 or 4 were considered by them to have been true double tumors. In 1934 Pearlman[3] was able to find in the literature only 17 cases of this type of tumor in the esophagus itself, and even in these he suggested the possibility that they were not representative of true carcinosarcoma. The histopathological features of these esophageal tumors as listed by Pearlman consisted of epithelial and sarcomatous elements. Some of the epithelial elements were definitely stated as squamous cell, while the cells of the sarcomatous elements were usually described as spindle and occasionally pleomorphic. Since Pearlman's[3] review of carcinosarcomas of the esophagus, we have been unable to find any additional cases reported in the literature. Recently, however, we did encounter a highly unusual type of double tumor in the esophagus, a tumor which was composed of both squamous cell carcinoma and rhabdomyosarcoma. Since we have been unable to find a similar tumor reviewed in the literature, and as carcinosarcoma itself is quite rare, we believe a report of this case is warranted.

CASE REPORT

The patient was a colored male, aged sixty-one, who was well until August, 1947, at which time he noted a sensation of fullness in the epigastrium associated with a desire to eructate. Subsequently, difficulty in swallowing solids developed and food seemed to lodge just above the level of the xiphoid process. About the first of May, 1948, the patient developed a persistent burning pain in the epigastrium with some radiation into the substernal region and it was this complaint that prompted him to enter the hospital on May 4, 1948. At no time had he vomited nor had he had melena. Upon the administration of belladonna he was able to eat soft foods without difficulty. The patient was esophagoscoped and a biopsy from a visualized mass revealed a Grade 3 epidermoid carcinoma. A roentgenogram showed an irregular obstructing lesion beginning at the level of the bifurcation of the trachea and extending downwards approximately 7 cm. Within this irregular area there were polypoid invaginations indicating tumor mass, with zones of narrowing indicating an annular constriction. The portion of the esophagus proximal to the zone of narrowing was dilated. Its diameter was approximately three times the normal width at this level (Fig. 1). The distal esophagus below the level of the tumor appeared normal. At that time the position of the carcinoma made the possibility of a tracheo-esophageal fistula an imminent potentiality. The patient refused surgery or radiation therapy and left the hospital on June 12, 1948. On July 8, 1948, the patient was readmitted. Just prior to his readmission the patient's condition had become worse; he noticed that food continued to lodge in his esophagus inducing a severe paroxysm of coughing which resulted in emesis. Roentgenograms on July 8, 1948, following a swallow of diodrast, showed a tracheo-esophageal fistula with the opaque medium passing into the tracheobronchial tree and demonstrating the left lower lobe (Fig. 2). The perforation was at the level of the carina. A small amount of opaque medium passed through the esophagus into the stomach. A mottled density, indicating a pneumonic proc-

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FIG. 1. Roentgenogram of the chest revealing obstructing lesion at the level of bifurcation of the trachea with proximal dilated segment.

ess, was also seen in the left base which later gradually increased in size. July 14, 1948, a Stamm gastrostomy was performed for feeding purposes. For a while the patient seemed to do well postoperatively, but in spite of therapy the pneumonic process progressed. On August 5, 1948, roentgenograms showed complete opacity of the left hemithorax. During his stay in the hospital the laboratory findings revealed a gradual increase of anemia, and the white blood cell count never went above 11,600. The patient's condition continued to be retrogressive and he died on August 10, 1948.

Autopsy Findings. The body was that of a sixty-two year old, extremely emaciated colored male. The abdomen had a gastrostomy opening in the left upper quadrant.

Lungs: The left lung weighed 600 grams. The cut surface revealed many small nodules throughout the lung from which purulent material was expressed on slight pressure. The bronchial tree was filled with a thick, white, purulent exudate. The left main stem bronchus at about 2 cm. from the bifurcation was almost completely obstructed by a fungating mass growing into its lumen. This mass measured 2.5 cm. in all dimensions. A probe could be passed from this region into the esophagus. The right lung weighed 500 grams and was crepitant throughout. In the hilus of the right lung there was a small area which was a distinct extension of the large tumor mass in the esophagus. The trachea contained a small amount of thin, white exudate. The mucosa appeared normal. The pleural cavities also revealed no abnormalities.

Esophagus: The esophagus, at approximately 5 cm. below the level of the sternoclavicular junction, revealed a large mass measuring approximately 12 by 7 by 5 cm. This mass destroyed the normal esophageal structure and completely obliterated the lumen. The portion of the mass at approximately the level of the bifurcation of the trachea revealed necrosis (Fig. 3). As previously described, the mass communicated with the left main stem bronchus and also extended into the hilus of the

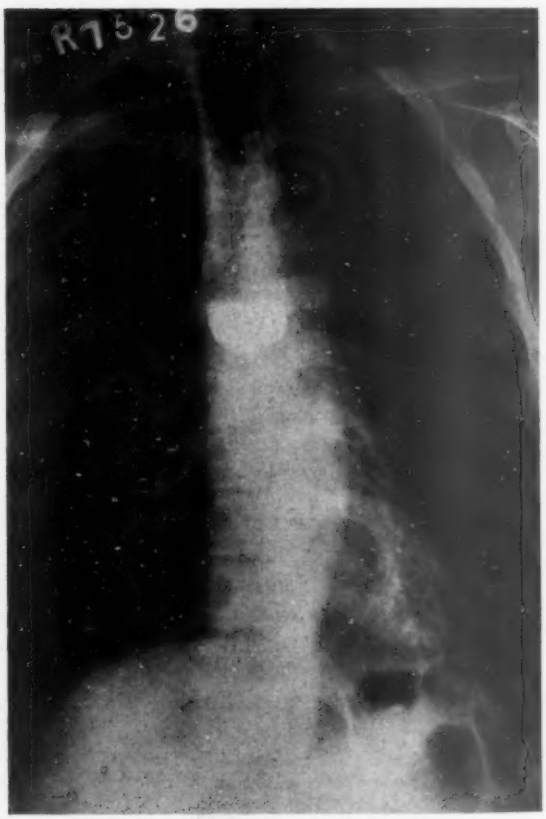

FIG. 2. Diodrast demonstrating tracheoesophageal fistula.

right lung. Except for its extension into these two areas, the mass was completely contained within the esophagus. The mass itself was very friable, soft and white; on cut sections there was very little evidence of vascularity (Fig. 4). The mediastinal nodes revealed gross evidence of tumor and several others showed calcification. The mass extended to within approximately 3 cm. of the stomach.

Stomach: About 3 cm. proximal to the pylorus, on the anterior surface there was an opening (gastrostomy) which had been connected with the skin surface.

No pertinent pathology was found in other organs examined.

Microscopic Examination.

Esophagus: Sections from the esophageal tumor revealed two elements: an epidermoid carcinoma with a tendency to keratinization and a sarcoma in which definite cross striations were evident. These cross striations were quite prominent when the sections were stained with Mallory's phosphotungstic acid hematoxylin. The epidermoid elements were in small groups and had pleomorphic, hyperchromatic nuclei with small amounts of keratin. These epidermoid elements were surrounded by elongated broad sarcoma cells with pleomorphic hyperchromatic nuclei, many of which contained large nucleoli. The cytoplasm was abundant, granular and occasional cross striations were seen (Fig. 5). The quantity of each cell type varied in different portions of the tumor; in some areas it was entirely epidermoid in character, in others it was composed of immature striated muscle cells (Fig. 6), while in other areas, both elements were combined (Fig. 7). Large areas of necrosis were present throughout the tumor mass. At the periphery of the tumor the neoplastic cells partially invaded the wall of the esophagus but in the central portion the tumor communicated with the left main stem bronchus.

Fig. 4. Photograph of tumor mass with the esophagus opened. Probe points to the esophageal opening of the broncho-esophageal fistula.

Fig. 3. Photograph showing tumor communicating with the left main stem bronchus. Probe is in the broncho-esophageal fistula.

FIG. 5. Photomicrograph of cross striations stained with Mallory's phosphotungstic acid hematoxylin stain.

Lungs: The histopathology of the tumor protruding into the bronchus was similar to that in the esophagus, being composed of both epidermoid elements and immature muscle cells. There was also present a small area of tumor extending into the parenchyma of the right lung which was composed only of sarcomatous elements.

Sections from the left lung revealed diffuse patchy areas composed of polymorphonuclear leukocytes with small amounts of fibrin within the bronchioles and adjacent alveolar spaces. Occasionally areas showed early organization by fibroblasts and new capillaries. There were no additional metastases found.

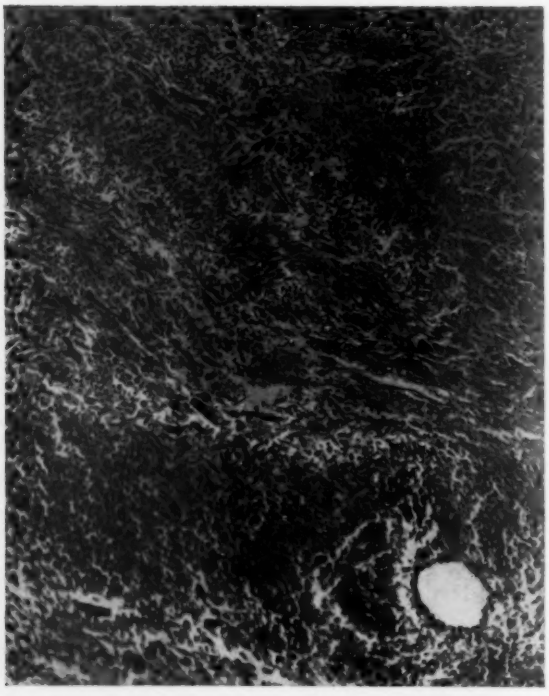

FIG. 6. Photomicrograph of an area composed entirely of sarcomatous elements.

FIG. 7. Photomicrograph revealing both epidermoid carcinoma and sarcomatous elements.

DISCUSSION

It is believed by some authors that many of the "so-called carcinosarcomas" are merely carcinomatous lesions, with areas of marked anaplasia simulating sarcoma. It is well known that the spindle-shaped epithelial tumor cells can be easily mistaken for connective tissue tumor cells. Pearlman[3] suggested that the diagnosis of carcinosarcoma of the esophagus is questionable, believing that most of the cases were anaplastic carcinomas or squamous cell carcinomas with transitional cell features. These transitional cells were often elongated, spindle shaped, and confused with sarcoma.

Meyer[2] suggested that these tumors may originate in one of three ways:

1. "Collision tumor," where two malignancies of separate points of origin collide and invade each other.
2. "Combination tumors" where one stem cell gives rise to two blastomatous portions.
3. "Composition tumors," where the parenchyma and stroma of the tumor has become malignant.

In our case a decision as to which group the tumor would fall into is difficult. It has been suggested by the Army Institute of Pathology[1] that this is a true double tumor thus falling into the category of collision tumor as described by Meyer.[2] This, of course, is an extremely rare type of tumor. The Army Institute of Pathology does not have a well authenticated case of collision tumor on record. If this is a true concept of this lesion, the sites of origin cannot be stated with any certainty. It has been suggested[1] that in this case a squamous cell carcinoma of the esophagus had collided with a rhabdomyosarcoma of the lung. It is possible, however, that the two cell types may have arisen entirely from the esophagus and invaded the lung.

The clinical course of this lesion was similar to that of the usual squamous cell carcinoma of the esophagus.

CONCLUSION

Carcinosarcomas of the esophagus are rare tumors. Up to the present date only seventeen cases have been reported. Ours is the eighteenth case and is apparently the first reported case of a squamous cell carcinoma and rhabdomyosarcoma producing a double tumor, possibly of the collision type as described by Meyer.[2]

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REFERENCES

1. Army Institute of Pathology. Personal communication.
2. Meyer, R. Beitrag zur Verständigung über die Namengebung in der Geschwulstlehre. *Centralbl. f. allg. Path. u. path. Anat.*, 1919, *30*, 291–296.
3. Pearlman, S. J. So-called carcino-sarcoma of esophagus. *Ann. Otol., Rhin. & Laryng.*, 1940, *49*, 805–820.
4. Saphir, O., and Vass, A. Carcinosarcoma. *Am. J. Cancer*, 1938, *33*, 331–361.

DESCRIPTION OF AN Sr^{90} BETA-RAY APPLICATOR AND ITS USE ON THE EYE*†

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BETA rays for therapeutic purposes about the eye have been utilized for a number of years and considerable experience has been gained with this form of therapy.[2,5] The use of beta radiation rests upon the desire to exploit the unique physical characteristics of beta rays, one of which (rapid absorption in tissue) limits the radiation to a few millimeters of the surface structures, thereby avoiding damage to deeper tissues. Until recently, beta-ray sources were dependent entirely upon naturally occurring radioactive elements and were fashioned from radium and its daughters, most of the applicators being made from radon. With the development of nuclear piles or nuclear reactors, large amounts of artificial radioisotopes, some of which are particularly useful as beta-ray sources, have become increasingly available.

In our own institution we have, previously, utilized radon as a source of beta rays. However, we have considered the radon applicator unsatisfactory for the following reasons:

1. The radon required replacement at regular intervals because of the rapid decay (half-life 3.82 days).

2. Protection against the gamma radiation, although not a difficult problem, required constant attention.

3. The glass capsules containing the radon were found to vary in thickness so that calibration by means of the gamma rays emitted did not accurately reflect the beta-ray dosage.

A careful review of the beta-ray emitters which were available either from natural sources or by artificial production in the nuclear piles was, therefore, made. The following table (Table 1) lists those elements which have a half-life of at least two weeks and which appear suitable for this purpose.

In selecting an element as a beta-ray emitter, the following criteria appeared applicable:

1. Sufficiently long half-life to avoid frequent replenishment of the element.

2. Sufficient energy of the beta particle to permit effective penetration in tissue.

3. Absence of accompanying gamma radiation and ease of protective measures.

4. Suitability of the element with regard to its chemical and physical properties so

TABLE I

Isotope	Energy in mev.		Half-Life
	Beta Rays	Rays	
P^{32}	1.69	None	14.3 days
Rb^{86}	1.60		19.5 days
Sr^{89}	1.50	None	55 days
Sr^{90} } series	0.65	None	25 years
Y^{90} } series	2.23	None	62 hours
Y^{91}	1.53	None	57 days
Ru^{106} } series	Very soft	None	1 years
Rh^{106} } series	3.55 (82%)	1.25 (1%)	30 seconds
	2.30 (18%)	.73 (17%)	
		.51 (17%)	
RaD } series	0.025	0.047	22 years
RaE } series	1.17	None	5 days
Rn	None	None	3.825 days
RaA } series	None	None	3.05 minutes
RaB } series	0.65	None	26.8 minutes
RaC	3.15	1.8	19.7 minutes
Ux_1 } series	0.13	0.092	24.1 days
Ux_2 } series	2.32	0.802	1.14 minutes

* From the Departments of Radiology and Surgery (Division of Ophthalmology), Western Reserve University and University Hospitals of Cleveland. Presented at the Fiftieth Annual Meeting, American Roentgen Ray Society, Cincinnati, Ohio, Oct. 4–7, 1949.
† Most of the work was performed under Atomic Energy Commission Contract No. W-31-109-eng-78 with Western Reserve University.

that ease of manipulation, high chemical purity, high specific activity, etc., would be possible.

As a result of this survey, the isotope Sr^{90}, having a daughter product Y^{90}, was chosen. The long half-life (twenty-five years), the energetic particle (2.23 mev. peak), the absence of nuclear gamma rays, and the comparative ease of manipulation, seemed to satisfy the requirements which we had established. In addition to this, an examination of the beta-ray spectrum of Y^{90} (Fig. 1)[3] reveals an especially good energy distribution in comparison with other readily available elements.

Ru^{106}-Rh^{106} series, and the RaD-RaE series, also appear promising as beta-ray sources because of their long half-lives. However, the beta rays from RaE (see (Fig. 1) have an average energy of 0.33 mev.,[4] corresponding to a range of 0.9 mm. in water. This limits the usefulness of this element since it can be used only for very superficial irradiation. The Ru^{106}-Rh^{106} series has a considerably shorter half-life in relation to the Sr^{90} series, and would require frequent recalibration. However, it has a very energetic particle and might prove particularly useful under certain circumstances. Plans have been made to incorporate this element into an applicator for purposes of comparison with the Sr^{90} applicator.

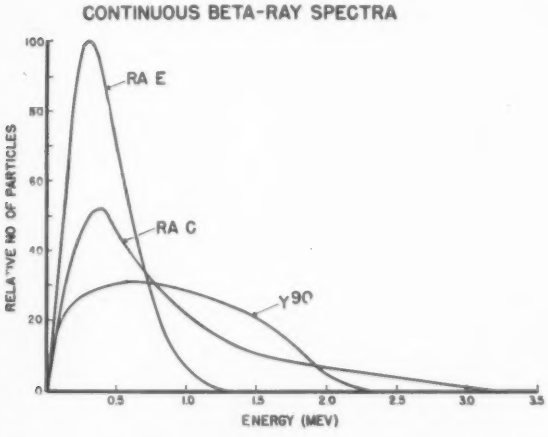


Fig. 1. An examination of the spectra would indicate that although the peak energy of the RaC beta ray is approximately 1 mev. greater than the peak energy of the beta rays from Y^{90}, the depth dose might be quite comparable. The average beta-ray energy for the Y^{90} particle is 0.9 mev.[6] while the average energy of the RaC beta ray is in the order of 0.7 mev. The ranges in water, tissue equivalent, associated with beta-ray energies 0.9 mev. and 0.7 mev. are 3.9 mm. and 2.5 mm. respectively. It may also be observed that RaE would be inferior to both RaC and Y^{90}.

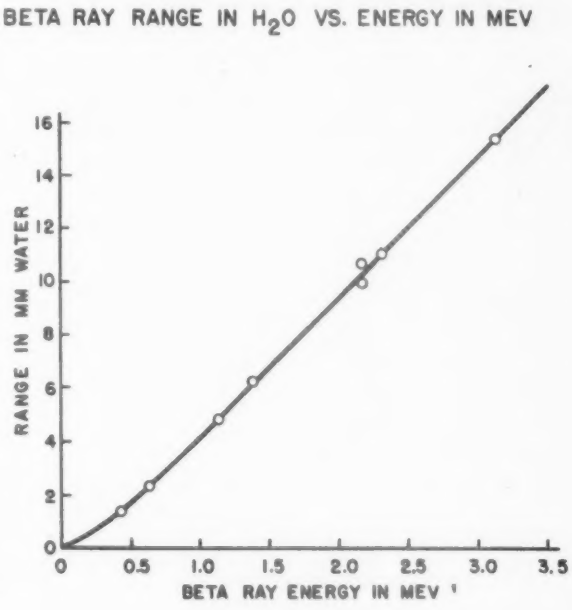


Fig. 2

Figure 2 indicates the relationship between the range in water and the energy of the beta particle.

A suitable Sr^{90} applicator was, therefore, constructed and subjected to a series of physical measurements to determine surface and depth dose. The surface dose was found to be 5.39 roentgen equivalents* (rep) per second with a half-value layer of 150 milligrams per square centimeter of aluminum. (See section on Physical Measurements.) The depth dose distribution is shown in Figure 8, along with similar curves for representative radon bulbs and 30 kv. (peak) superficial roentgen rays.[8] These latter curves are added for purposes of comparison.

* Roentgen equivalent is used in this paper to designate the amount of radiation which produces in tissue phantom the same amount of ionization produced by 1 roentgen of gamma rays in air, that is, 1 esu per cc. at std. conditions. Roentgen equivalent is equal to the rep.

DESCRIPTION OF THE Sr^{90} APPLICATOR AND PROCESS OF PREPARATION

A drawing of the Sr^{90} applicator described here appears in Figure 3. As may be observed, the radioactive strontium is enclosed in a narrow space below the aluminum plug, (A). During the process of filling, Sr^{90} is first introduced into a lucite capsule (B) in order to avoid corrosion—the Sr^{90} being in the form of an acid solution of strontium chloride. The lucite capsule was then placed in an aluminum container (C) in order to permanently enclose the active agent. It had previously been found that under intense irradiation by energetic beta rays, lucite tends to break down and disintegrate.* A small amount of calcium chloride (D) was added in order to take up any moisture which may not have been removed during the filling process.† After the aluminum cap was inserted into the outer capsule, thus holding the inner capsule firmly in place, a quantity of De-Khotinsky cement was poured into the well shown at the top of the applicator, and a shield of lead (E) fitted over the whole

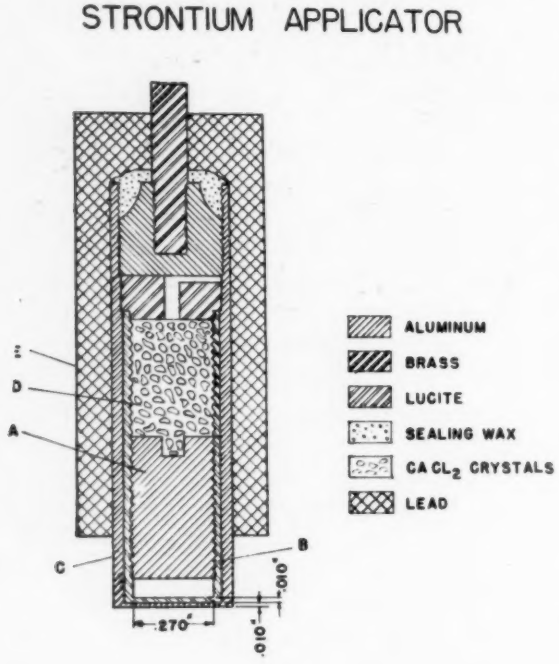
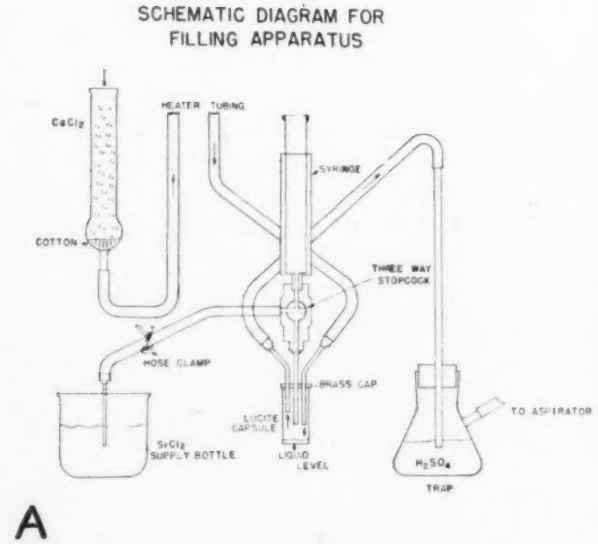


FIG. 3

* In conversation, Dr. F. C. Henriques of Tracerlab, Inc., concurred and indicated that this phenomenon occurs in other plastics as well.

† Actually, due to an accident during filling, a drop of water was left in the bulb. This water served as a medium to transport Sr^{90} from the treatment end of the bulb to the upper end and thus resulted in a decrease in rep output to 5.39 rep/sec., a figure which is much too low for the radiation due to the 100 mc. of Sr^{90} used in the bulb.



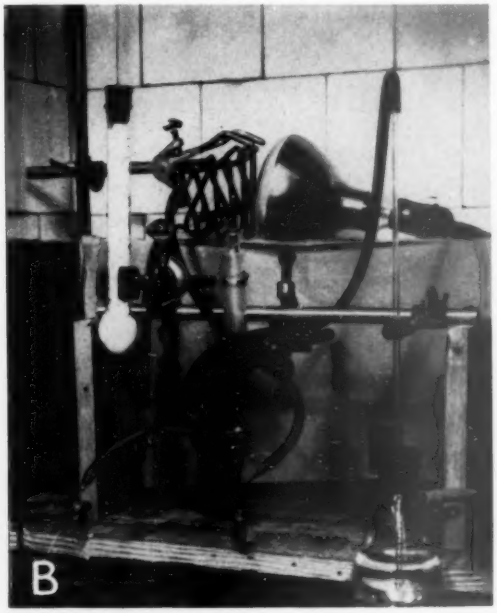


FIG. 4. (*A*), (*B*).

assembly except for the treatment surface. The lead shield was included to minimize any radiation emitted from the sides and rear of the bulb.

The filling process itself was carried out in a completely enclosed system (Fig. 4 *A* and *B*), which, in turn, was placed in a disposable container with an adequate hood. The process consisted of evaporating, drop by drop, 16 ml. of $SrCl^2$ solution (containing approximately 100 mc. Sr^{90} and 100 mc. Y^{90}) in the bottom of the lucite capsule, the evaporation being facilitated by drawing warm dry air over the surface of the liquid in the capsule. Care was taken during evaporation to make sure that the level of liquid within the capsule never rose higher than $\frac{1}{8}$ inch from the bottom, thus assuring a distribution of activity only on the treatment end of the capsule (see footnote†). As a precautionary measure, the air which was drawn over the solution was bubbled through a trap containing sulfuric acid, to remove any Sr^{90} which might have escaped. Frequent assays were made of the sulfuric acid and the water passing through the aspirator used to accomplish the air flow—no activity being detected. Due to the slow rate of evaporation, the filling process required approximately ten days for completion. A more even distribution was obtained by this means than might have been obtained by intense heating which tends to produce spattering. Even by this means of evaporation, the radioactive material was distributed unevenly, being concentrated in areas about the periphery of the treatment surface of the applicator (Fig. 5).

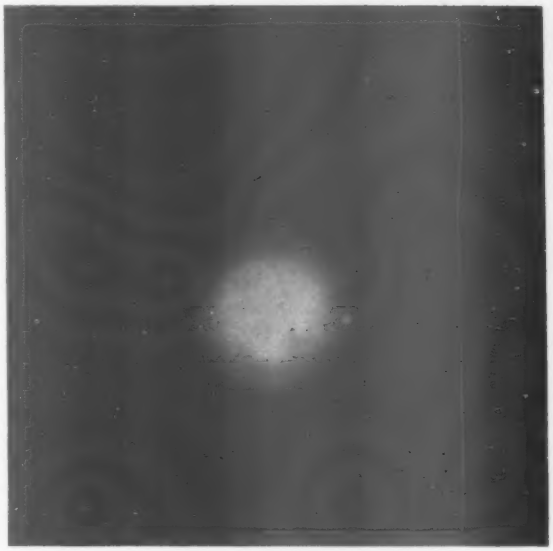


Fig. 5

PHYSICAL MEASUREMENTS

The physical measurements of the radiation emitted by the Sr^{90} applicator consisted of two parts:

1. Determination of the penetration of Sr^{90}–Y^{90} beta particles through the lucite and aluminum capsules and subsequent estimation of the half-value layer of the remaining radiation by means of absorption in aluminum.

2. Careful ionization measurements of the roentgen equivalent, or rep, output at the surface of the applicator and at varying depths in a tissue phantom.

The first part of the measurements consisted of placing a small amount of the $SrCl_2$ solution to be used for the filling process in a depression in a glass rod which was supported in a vertical position in a block of wood. This radioactive source was measured at an arbitrary distance, using a Geiger counter, under three conditions: (1) without filtration, (2) with a lucite capsule over the source, and (3) with a lucite and aluminum capsule filtering the source. Further counts were then made using additional aluminum absorbers of known thickness and an absorption curve was plotted. The results of these counts is shown in the following compilation:

Sr^{90}–Y^{90} source with no filter	10,050 c/m.
Same source covered with lucite capsule (Calculated thickness = 30.5 mg/cm².)	8,200 c/m.
Same source covered with lucite and aluminum capsules (Calculated thickness = 99.1 mg/cm².)	5,125 c/m.
Half-value layer from absorption curve	150 mg/cm².

Thus, 51 per cent of the impinging beta radiation is transmitted by the treatment

ends of the lucite and aluminum capsules. It is certain from this figure that almost all of the radiation which leaves the bulb originates from the more energetic disintegration of Y^{90} (0.90 mev. average) since the average energy particle from Sr^{90} (0.22 mev. average) is stopped by approximately 40 mg/cm.[2]

Radiation output and depth dose measurements of the strontium applicator were

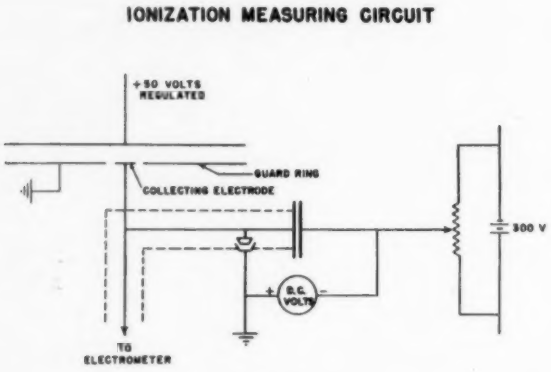


FIG. 6

made by means of an extrapolation ionization chamber, of the type described by Failla.[1] The lower plate of the ion chamber was made of lucite 1/16 inch thick and was coated with aquadag to render it conducting. An insulating ring was scratched through this aquadag coating with a compass, thus yielding a center circle of aqaudag and a surrounding guard ring also of aquadag. The center circle, or collecting electrode, had a diameter of 0.5 inch (area 1.265 sq. cm.) and the guard ring had an outside diameter of 11 inches, thus assuring a parallel electric field when the collecting electrode and the guard ring were maintained at the same potential.

Two upper or anode plates were used during the measurements, the first for determining surface dose in roentgen equivalents per second, and the second for determining depth doses in lucite phantom. The first of these consisted of a ¼ inch lucite plate which had a hole bored in the center to accommodate the strontium applicator in such a way as to allow the treatment face to lie in the plane of the bottom surface of the plate. The bottom of this plate was then coated with aquadag, yielding a continuous surface containing the treatment end of the applicator. The second plate was identical to the first, except that a 1 mm. layer of lucite was left in the bottom of the aperture into which the applicator was placed. This layer of lucite, along with two 1 mm. thick lucite discs which could be placed in the hole beneath the applicator served as phantoms for measuring rep dosages at 1, 2 and 3 millimeters depth.

The collecting electrode of the ionization chamber was connected by means of a shielded coaxial cable to one terminal of a shielded four-way junction. This junction also included a connection to a Lindemann electrometer, to one side of a measured value condenser (57 ± 5 per cent) and to a shielded grounding key (Fig. 6). A collecting electric field was obtained in the ion chamber by applying a potential of 50 volts to the top plate and grounding the guard ring and collecting electrode, the latter by means of the shielded grounding key. With the strontium bulb in place, the collecting electrode was ungrounded, thus allowing it to float. Then, using the Lindemann electrometer as an indicator, the potential of the collecting electrode was maintained at ground by varying the potential on the far side of the measured condenser. By measuring the time required for a given voltage change on the condenser while maintaining the collecting electrode at ground potential, the time rate of change of voltage was determined. Using this rate in the following equation, the ionization current* in esu/sec. was determined:

$$i = CdV/dr(3 \times 10^9)$$

where:

C = capacitance of measured condenser in farads

dV/dt = time rate of change of potential applied to C.

* In later measurements, ionization current was measured by means of a Beckman micro-microammeter which was tested and found to give comparable results to the above measuring setup with considerably more convenience.

Depth dose measurements were made at 0, 1, 2 and 3 mm. below the surface. Beyond this level the radiation was so low that further measurements were considered of little consequence. Readings were taken for each of these depths for plate spacings from 1 mm. down to 0.25 mm. At least five separate readings were taken for each plate spacing at each depth. A curve of ionization current in esu/sec. versus plate spacing in centimeters was plotted for each depth using these measurements. Since the slope of the lines are of primary significance, improper plate spacing does not affect the results. The shifts in plate spacing were correct to 0.01 mm. The slope of the lines was determined by the method of least squares and the curves were redrawn through zero (see Fig. 7). The slope is then in esu/sec. cm. units and the slope divided by the area of the collecting electrode (in square centimeters) results in esu/sec. $cm.^3$ units. It is clear that from the definition of the roentgen these units correspond to roentgen equivalent, or rep, per second, assuming standard conditions. Thus, from each curve a value of dosage in rep/sec. was obtained (Table II). These values were then converted into percentage of the dose at zero depth and were plotted against depth and millimeters, as shown in Figure 8.

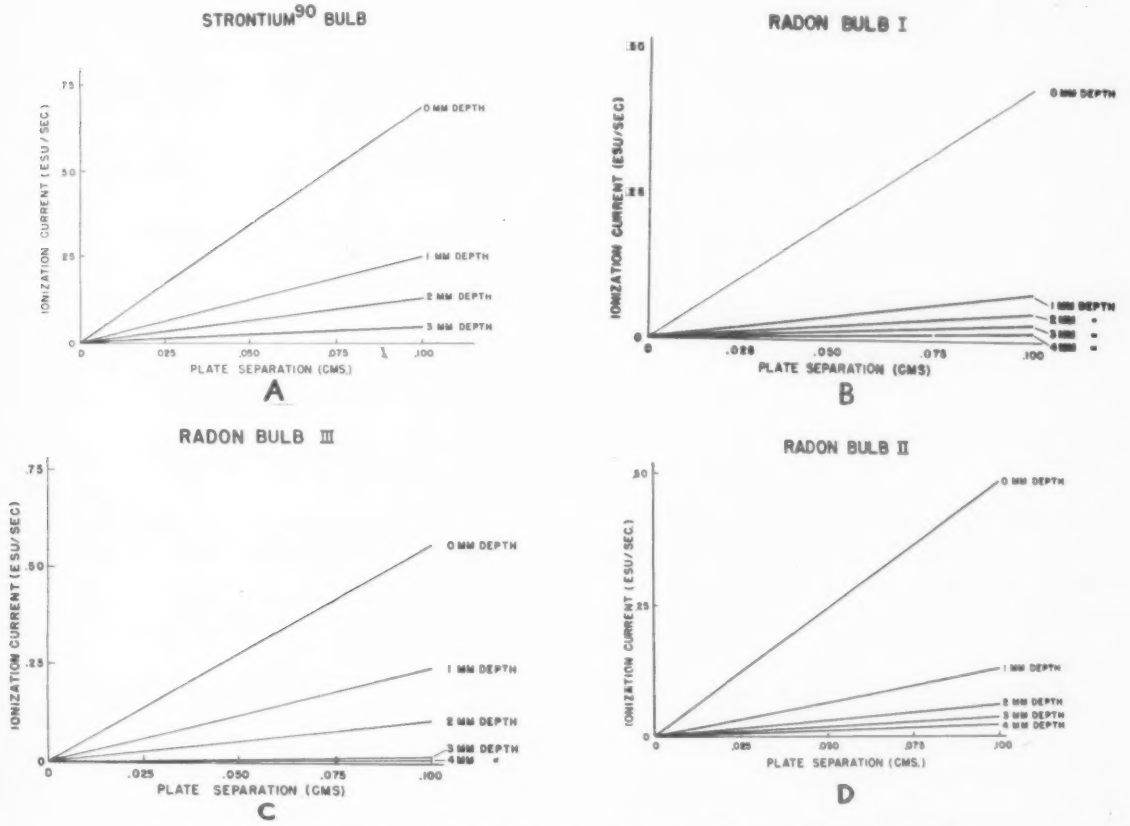


FIG. 7. (*A*) Sr^{90} curves. (*B*) Radon Bulb I. (*C*) Radon Bulb III. (*D*) Radon Bulb II.

For purposes of comparison, similar measurements were made on three radon bulbs with strengths of 50,* 64 and 78 mc. respectively, as determined by gamma-ray measurements. The curves of ionization current and depth dose for these bulbs are shown in Figures 7 and 8, together with similar curves for the strontium bulb.

* Estimated, since bulb appeared to be leaking slowly.

TABLE II

	Depth (mm.)	Slope of Curve (esu/sec/cm.)	Dose (rep/sec.)	Per Cent of Surface Dose
Strontium bulb:	0	6.82	5.39	100
	1	2.80	2.21	41.0
	2	1.20	0.95	17.6
	3	0.506	0.40	7.4
50 mc. radon bulb:	0	4.336	3.43	100
	1	0.832	0.66	19.2
	2	0.480	0.38	11.1
	3	0.272	0.22	6.3
	4	0.160	0.13	3.7
64 mc. radon bulb:	0	4.91	3.89	100
	1	1.30	1.03	26.5
	2	0.627	0.50	12.8
	3	0.357	0.28	7.3
	4	0.210	0.17	4.3
78 mc. radon bulb:	0	5.56	4.39	100
	1	2.40	1.90	43.2
	2	1.12	0.89	20.1
	3	0.593	0.47	10.7
	4	0.370	0.29	6.7

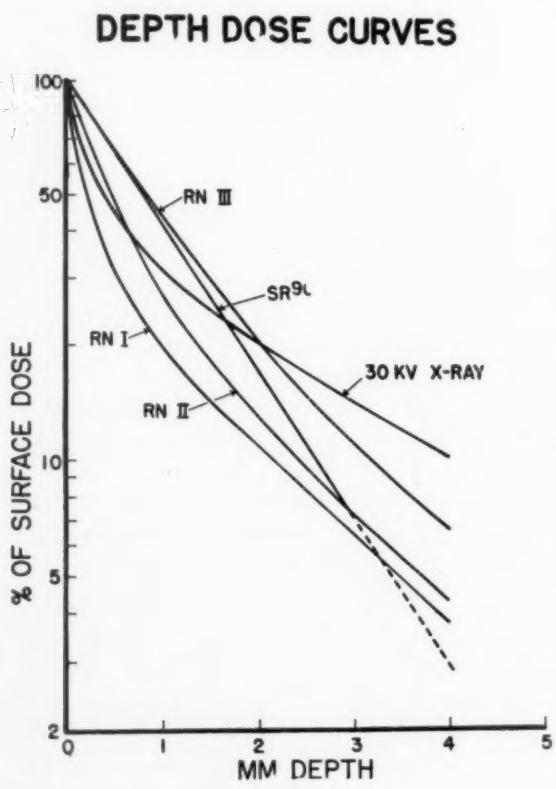


FIG. 8

Values for the roentgen equivalent dose for various depths for the radon bulbs are shown in Table II.

It is observed that the depth dose curve for the strontium applicator is semi-logarithmic in character. This is probably fortuitous since we are dealing both with energy loss by absorption and by the inverse square law. However, this straight line tends to indicate that the radiation arising from the strontium applicator consists primarily of one group of beta particles having a single peak energy rather than from a spectrum of beta particles made up of two peak energies. This is in keeping with the physical make-up of the applicator, since, as noted in reference 1, under measurements, the beta particles from the enclosed Sr^{90} and Y^{90} must pass through approximately 100 milligrams per square centimeter of absorber before leaving the bulb. This amount of material should absorb most of the low energy particles from Sr^{90}, leaving only the more energetic particles from Y^{90}.

The shape of the absorption curves of the three radon applicators is the type expected when the emitter contains beta particles of more than one peak energy. Since the walls of the radon bulb are very thin glass (fractional millimeters), it is probable that a significant amount of the low energy radiation from RaB (0.65 mev. peak) leaves the bulb along with the radiation from RaC (3.15 mev. peak) thus resulting in the type of curve shown in Figure 8. The variations in depth dose for the three radon bulbs may also be attributed to the RaB beta rays, since for variations in bulb thickness of the order of tenths of millimeters, considerable variation will result in the number of low energy beta rays emitted. These variations will change the quality of the emitted radiation and will result in different slopes of the depth dose curves up to a point at which all of the low energy radiation is removed, leaving radiation of essentially the same quality. At this point, the curves should become parallel as are the curves in Figure 8.

CLINICAL APPLICATION

Sr^{90} beta rays have been applied clinically and a series of cases treated by this means were compared with a similar series in which beta rays from radon have been used. No demonstrable difference in the biological effectiveness of the two sources appeared—efforts being made to approximate the dosage in the two groups. With the Sr^{90} applicator the treatment was applied in direct contact for sixty seconds, giving a dose of approximately 325 rep. (As noted above, the Sr^{90} beta-ray applicator emits 5.4 roentgens per second at the surface.) All treatments have been given by the direct contact technique since this is the only manner in which the dose to the tissue can be carefully regulated.

In order to check the physical measurement of the dose biologically, a parallel series of exposures with the radon and Sr^{90} applicators were made on the skin. Figure 9 illustrates the appearance of the radiation changes. This type of study was made in order to insure the fact that no wide discrepancies in dosage rate and biological effectiveness existed between the two sources. In addition to this, before clinical use of the Sr^{90} applicator was made, the effects upon vascularization and mucous membrane reaction were studied in animals. The ocular mucous membrane and the conjunctival vessels in the region of the superior rectus muscle were found to be quite accessible in rabbits for these studies. Microscopic examination was carried out on these blood vessels without evidence of any essential difference in the degree of vasculitis produced by either the radon or Sr^{90} applicator.

The conditions which appear favorable for radiation are:

1. *Superficial Tumors.* Small, benign tumors and shallow growths that cannot be excised, especially papillomas of the lids and conjunctiva, respond well to beta radiation. Bowen's disease, or intra-epithelial epitheliomas can be destroyed without risk of deeper damage. Angiomas of the lids and conjunctiva in infants respond to beta radiation if treated early. In those types of lesions the response is generally prompt and the cosmetic results excellent. (Usually one or two treatments of 325 rep each are sufficient.)

Pterygia, of either the true or pseudo variety, recurrent pterygia, and enlarged pinguecula, all respond very satisfactorily to beta radiation. Our usual course has been 325 rep at weekly intervals to a total of four treatments (Fig. 10).

2. *Vernal Conjunctivitis.* Early cases of vernal conjunctivitis show excellent therapeutic response to beta radiation. In early cases, the papillae consist of proliferating, young fibrous tissue, new vessels, and lymphoid cells, all of which are radiosensitive. Long-standing cases show the typical cobblestone plaques with hyaline degeneration and are definitely more resistant to radiation and often must be removed by excision with subsequent beta radiation. In applying the radiation, special attention must be given to the upper edge of the

tarsal cartilage since the follicles in this region cause the most troublesome symptoms (Fig. 11a and 11b, 12a and 12b).

3. *Anterior Segment Tuberculosis.* The work of Woods has shown that anterior ocular tuberculosis is favorably treated in more than 50 per cent of the cases observed. Recurrences are not decreased, but the irradiation appears to have a beneficial effect on the immediate attack. The limbal type of follicle hypertrophy with corneal infiltration that has an appearance similar to phlyctenule responds to irradiation with special predisposition. The mode of action is not known, but it may be due to a radiosensitivity of the lymphoid and giant cells which degenerate and are replaced by fibrous tissue.

4. *Vascularization of the Cornea.* Beta radiation is used both to prevent and to obliterate corneal vascularization. It inhibits the proliferation of capillary endothelium in newly forming vessels—infiltrating loops being stopped short by beta radiation. Larger and well established vessels can also be obliterated by larger doses of beta radiation directed to the limbus—the radiation inducing an obliterative vasculitis and final occlusion. The radiation has been administered in courses, usually totaling 1,300 rep, in a period of one month (325 rep × 4). During this time the patient's reaction to the radiation may be observed.

The radiation, except in selected cases, must be applied to the limbal regions only. Any treatment to the central region of the cornea must be done only with great caution and at infrequent intervals, since perforation of the cornea may be readily produced by excessive radiation.

Vascular obliteration by means of beta radiation has proved favorable in the following circumstances:

a. In trachomatous pannus. Treatment is effective because of marked vascularity of the lesion. One also frequently observes

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FIG. 9. This figure depicits parallel exposures with the Sr^{90} and radon applicators. Extending from below upwards the dose with the Sr^{90} applicator was 270 rep, 540 rep, 810 rep, 1,080 rep and 1,620 rep. With the radon bulb, extending from below upwards, the dose was 350 rep, 700 rep, 1,050 rep, 1,400 rep and 2,100 rep. These reactions were photographed ten days following the application of the radiation. The radon exposures are somewhat more intense and after calibration it was found that the dosage in rep was actually somewhat higher, as may be observed from the dosage figures.

FIG. 10. This is a case of recurrent pterygia, one year after the second operation. This patient received 650 rep following the second operation.

FIG. 11a. This is a case of vernal conjunctivitis involving the upper lid prior to treatment.

FIG. 11b. Same case—after treatment with 2,000 rep (Sr^{90} applicator). Several follicles remain, indicating necessity for some further treatments.

FIG. 12a. A case of limbal vernal conjunctivitis that responded readily to 325 rep×2, one week apart. (Sr^{90} applicator.)

FIG. 12b. Appearance following radiation therapy. The patient was completely free of allergic symptoms after treatment. This type of lesion responds more readily than do palpebral lesions. Recurrences are greatly diminished by radiation therapy, especially if this is continued during the time of year when the patient is free from allergic symptoms.

FIG. 13a. This is a case of vascularized keratitis before superficial keratectomy.

FIG. 13b. This shows the same case twenty-four hours following keratectomy at which time irradiation was begun. This case received 325 rep (Sr^{90} applicator) to each limbal quadrant twenty-four hours after operation and again one week after operation.

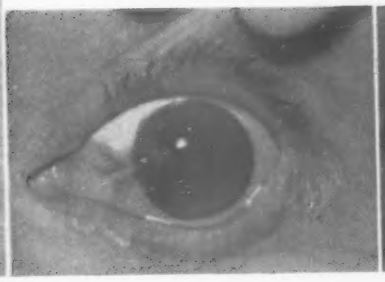
FIG. 14a. This illustrates a vascularized keratitis following acid burn of the cornea.

FIG. 14b. Radiation was given one year after the injury and the results following 325 rep×6, at weekly intervals (Sr^{90} applicator), are shown in this figure. The vascular obliteration can be seen in the nasal half of the cornea.

FIG. 15a. Chronic ulcerative keratitis due to a secondarily infected dentritic ulcer.

FIG. 15b. Post-radiation appearance of case shown in Figure 15a. This was resistant to all forms of treatment for approximately six months. Following the application of beta radiation (325 rep at weekly intervals×6, with Sr^{90} applicator) the eye was entirely symptom free and the ulcer replaced by scar.

9



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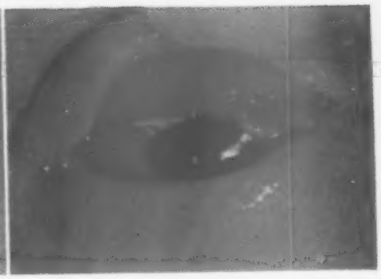
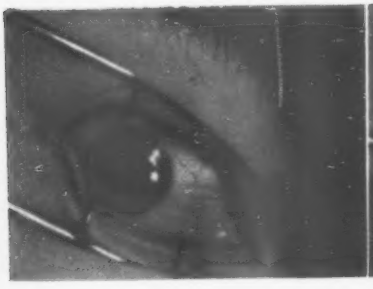


11a

11b

12a

12b



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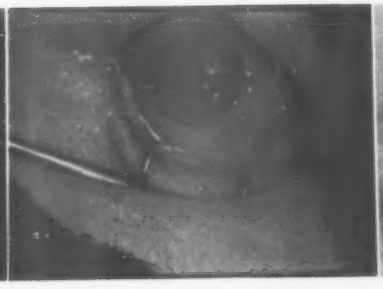
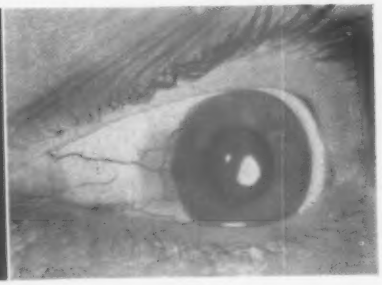
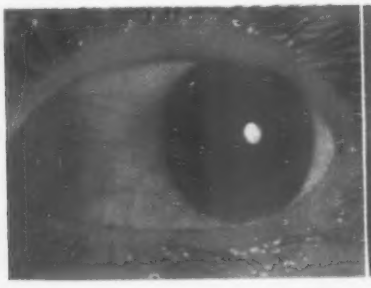


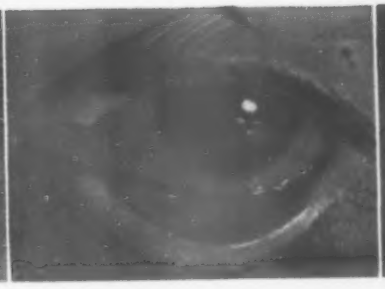
13b



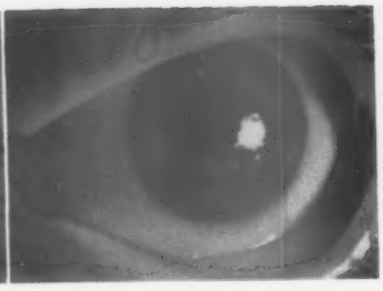
14a



14b



15a



15b

a decrease in the intracellular infiltration of the corneal stroma after treatment.

b. For prevention of revascularization of the corneal stroma after superficial keratectomy. Treatment should be started after the first twenty-four hours and applied to the limbus (Fig. 13a and 13b).

c. Prior to corneal transplant for prevention of vascular invasion. This has proved to be an invaluable aid to the surgeon in performing the corneal transplant operation since the cornea must be avascular before this operation is contemplated (Fig. 14a and 14b).

d. For prevention of vascular invasion following corneal transplant. There is a possibility of vessels reinfiltrating the graft from the surrounding cornea or limbus if the graft is near the latter. Apparently occluded vessels appear to reopen partially following the trauma of corneal grafting.

e. In vascularized corneal leukomas which are associated with symptoms of irritability, photophobia, and lacrimation. Chemical burns of the cornea are often associated with this clinical picture and are greatly relieved by beta-ray therapy.

5. *Corneal Ulcers*. Certain forms of chronic ulcers are known to heal with beta radiation applied to the limbal region directly adjacent to the ulceration. There are no contraindications to this and it should be tried in stubborn or slowly healing ulcers. This is especially true if secondary pannus is present extending from the limbus to the ulcer edge.

Acute pyogenic corneal ulcers should not be treated by beta radiation. This treatment has proved unsuccessful and may be followed by perforation of the cornea. The ulcer itself should never be treated since perforation may easily occur. Treatment should be directed to the limbal region (Fig. 15a and 15b).

SUMMARY

Under certain conditions the short range of beta particles in tissue is particularly useful in radiation therapy. This is true in the eye where it is important to protect deeper structures, such as the lens, from deleterious radiation effect.

An Sr^{90} beta-ray applicator is described and the special advantages of Sr^{90} as a source of beta rays is presented. Surface and depth dose measurements of the applicator have been made, the dosage being recorded in roentgen equivalents.

The clinical uses of the Sr^{90} beta-ray applicator have proved satisfactory and are comparable to the clinical experiences in which the radon beta-ray source was used. Superficial tumors of the eyelids and conjunctiva, vernal conjunctivitis, anterior segment tuberculosis, vascularizations of the cornea and corneal ulcers have been treated with the Sr^{90} applicator.

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REFERENCES

1. Failla, G. Measurement of tissue dose in terms of same unit for all ionizing radiations. *Radiology*, 1937, *29*, 202–215.
2. Iliff, C. E. Beta irradiation in ophthalmology. *Arch. Ophth.*, 1947, *38*, 415–441.
3. Ketelle, B. H. Unpublished work on Y^{90} spectrum performed at Oak Ridge National Laboratories.
4. Marinelli, L. D., Brinckerhoff, R. F., and Hine, G. J. Average energy of beta rays emitted by radioactive isotopes. *Rev. Mod. Phys.*, 1947, *19*, 25.
5. Ruedemann, A. D. Beta radiation therapy. *Arch. Ophth.*, 1949, *41*, 1–4.
6. Rutherford, E., and others. Radiations from Radioactive Substances. Cambridge University Press, London, 1930, p. 408.
7. Seaborg, G. T., and Perlman, I. Table of isotopes. *Rev. Mod. Phys.*, 1948, *20*, 585–667.
8. Trout, E. D., and Gager, R. M. Physical characteristics of soft roentgen rays. Am. J. Roentgenol. & Rad. Therapy, 1949, *62*, 91–112.

DISCUSSION

Dr. Roscoe J. Kennedy, Cleveland, Ohio. The use of beta radiation in the treatment of eye diseases in recent years has become accepted. The first beta rays used were obtained from radon and contained about 3 per cent gamma rays. The presence of the gamma rays presents a certain danger to the operator but in over 5,000 treatments since 1941 I have never

seen any damage produced with the radon applicator. Recently there has been introduced a radium D applicator which emits essentially beta rays. The introduction of Sr^{90} by the authors gives us another source of pure beta rays, which from the discussion would seem to give results as satisfactory as those obtained from radon. The time element of about twenty seconds for each treatment with our radon applicator is of definite help in treating many patients, especially small children, since it is often difficult for the patient to hold his eyes still while the treatment is being administered. Sr^{90} requiring about sixty seconds per treatment would not seem to increase the time required enough to be considered a drawback to its use. However, radium D requiring a treatment time of several minutes to be effective begins to become impractical. Any increase of the strength of both the Sr and the radium D applicators to the point where the dose can be applied within less than one minute is, of course, desirable.

Since the use of beta radiation in ophthalmology, many diseases have been more easily treated and the time of healing shortened. Many lesions of the eyelid respond readily, such as small papillomas. Vernal conjunctivitis. both the palpebral and limbal type, is satisfactorily treated, although at times the palpebral type may require preliminary removal of polyps. Two to three treatments are usually all that are needed in the limbal type. Corneal scars, especially the nebula, are markedly benefited, and many of these patients show a tremendous increase in their visual acuity. I have seen patients go from as low as 20/70 to 20/20. Usually three or four treatments are sufficient. The dense leukomatous scars are not benefited a great deal as far as visual acuity is concerned, but if vascularization or irritation is present, this can be reduced and the patient be made more comfortable. In the treatment of these dense scars, one must be careful not to thin out the cornea too much and cause perforation. This has been known to happen in one or two cases. There is little or no danger of causing any lens damage as the penetrating effect is only approximately 2 to 3 mm. With the cornea being 1 mm. thick and the anterior chamber about 3 to 3.5 mm. deep, one is relatively safe. Ptyergia, if small, can be treated with beta radiation, but if large and showing any appreciable invasion of the cornea, they should be excised and this followed with beta radiation. Most of these cases require only one or two treatments postoperatively for the prevention of recurrence. Pseudopterygia respond much more favorably to beta radiation than to surgical removal. Epibulbar dermoids respond well to this form of therapy, and I believe much more satisfactorily than to surgical removal, which is often unsatisfactory. Corneal vascularity can usually be controlled readily with beta radiation. If possible, the beta radiation should be given primarily at the limbus to avoid any more exposure of the cornea than is necessary. Many chronic forms of ulcers with increased vascularization respond well. Interstitial keratitis with tremendous vascularization is a satisfactory type of disease to treat. The use of beta radiation has now become an accepted procedure both preoperatively and postoperatively in corneal transplant surgery. Beta radiation is of little or no value in the treatment of corneal dystrophies and in bullous keratitis.

In treating all types of corneal leasions, one must be careful not to produce trauma, inasmuch as these treatments are all given by contact. It is well to use a local anesthetic in all cases, such as 0.5 per cent pontocaine, and to reassure the patient that the treatment is not painful. There is usually little or no reaction following the treatment although occasionally the patient complains of smarting or burning, which may last from twenty-four to forty-eight hours. This can be controlled by the use of cold compresses or, if necessary, the instillation of a mild ointment, such as holocaine and epinephrine.

I feel that the authors should be congratulated on introducing a new source of beta radiation, which should prove of value in the treatment of certain ophthalmic conditions.

SUPRASPINATUS TENDINITIS

A SURVEY OF 300 CONSECUTIVE CASES TREATED BY ROENTGEN THERAPY

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THE frequency with which supraspinatus tendinitis occurs and the degree of disability which it may cause, entitles it to an important place in the consideration of lesions about the shoulder. Codman[8] and Painter[21] were among the first to recognize the syndrome and to establish it as a clinical entity. Since it is a disease of middle[1,8,23,27] and later life,[18,24] its incidence is probably increasing coincident with our aging population. It is considered to be the commonest cause of shoulder pain.[8,17]

In the literature the condition is known under a multiplicity of terms. Subacromial or subdeltoid bursitis,[1] peri- or para-arthritis of the shoulder,[1,9,17] peritendinitis calcarea,[15,16,23] calcifying tendinitis, supraspinatus syndrome,[2] and other names, have been used to identify the lesion. While the discomfort and disturbance of function are related to the shoulder joint, the lesion is entirely extrinsic to the joint proper. Surgical pathologic study was first reported by Painter and Codman about 1905 but was incomplete.[8,21] In 1915, Moschowitz[19] presented the first good histopathologic description. It must be recognized that all individuals show some degenerative changes in the supraspinatus tendon area after the age of fifty.[27] Relatively early aging processes occur in this area which are believed to have a mechanical basis of origin, possibly associated with man's transition to the upright position.[8] Somewhat similar tendogenetic lesions occur elsewhere, namely in the triceps tendon near the olecranon, the rotators distal to the capitulum radii, the flexors of the digitorum longus inserting into the phalanges, the tendon of the gluteus, the tendon of the adductor magnus, the tendon of Achilles and elsewhere.

PATHOGENESIS

It should be recalled that the tendons of the subscapularis, supraspinatus, infraspinatus and teres minor muscles converge and fuse with the capsule of the shoulder joint. The combined tendon-capsule cuff is attached to the superior margin of the tuberosities and anatomic neck of the humerus. The subdeltoid or subacromial bursa lies on this tendon cuff and the greater tuberosity and is covered by the deltoid muscle, acromion process and the coraco-acromial ligament. It is normally a thin-walled pouch about 1.5 inches in diameter, lined by synovial membrane, and acts as a bushing allowing free movement of the tendon under the acromion process during abduction of the arm.

It is the consensus that the lesion starts as a degenerative process in the tendon fibers, usually the supraspinatus portion of the cuff, but occasionally elsewhere in the components of the cuff.[13] Codman[8] drew attention to a "critical point" in the supraspinatus tendon near its insertion where this process starts. Due to a relative local ischemia brought about by disproportion of supply and demand, avascular necrosis of varying degree occurs in the tendon fibers.[5] Factors of inefficient mechanics,[8] attrition,[18] occupational strain,[12] and aging processes are possibly contributory. Gross trauma,[2,7,11,12] toxic factors[9] and vitamin E deficiency[25] also have been advanced as having etiologic significance, but this has not been established. The tensile strength of the degenerated fibers is reduced[27] resulting in a weakened condition which renders the tendon susceptible to strain. It is conceivable that physiological muscle pull would then traumatize and alter the physi-

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cal make-up of the tendon. It is probable that the supraspinatus tendon is the site of premature aging processes related to poor anatomical and functional adaptation. It is known that as the declining decades are reached, muscle, tendon and bone conditioning to exercise is impaired. Recovery from wear and tear runs into a deficit. Repair from minor strains and injuries becomes slower and less complete. As this is a disease of middle and later life, all these considerations have a bearing on the healing process of the secondary inflammatory phase of the disease. In the younger individual, the prognosis for the therapeutic control of the condition is considerably better than in the elderly patient. It is believed that gross trauma has been overemphasized as the primary etiologic factor in this condition.

Following the initial phase of degeneration in the tendon fibers, there occurs a non-suppurative foreign body reaction[4,24] with removal of the devitalized material. The inflammation generally extends in the tendon sheath and often into the overlying bursa and surrounding soft tissues. It should be noted, however, that the lesion never arises primarily in the bursa.[24] The tension produced by the inflammatory exudate gives rise to the distressing symptoms of pain and limitation of movement. Fibrin formation may occur, further tending to bind moving parts. The degenerative lesion, conditioned by diminishing blood supply, is irreversible, while the inflammatory reaction is reversible and tends to subside slowly spontaneously.[14,17] There are apt to be recurring episodes, which always produce some degree of residual fibrosis. Finally, the chronic inflammatory phase may occur in which there is persistent low-grade discomfort associated only with movement. Movements of the shoulder may be restricted by fibrosis in the chronic phase, but in the acute phase limitation of movement is associated with pain.

Calcific deposits are an interesting feature of the hyaline degenerative process. First observed roentgenographically about 1905 when roentgen-ray work was in its early stages of development,[17,21,27] it has come to be regarded as important supplementary diagnostic evidence of the degenerative lesion. However, the degenerative and inflammatory processes may be present without any demonstrable calcium deposit. Moreover, there may be a calcium deposit present in a degenerative area of the tendon or in the bursa without the symptoms of inflammation.[22] The calcium deposit first occurs in the degenerative fibers of the tendon but often spreads along the tendon sheath and is not infrequently observed to have ruptured into the subacromial bursa. It is usually of a putty-like consistency. Bosworth[6] reported calcium deposits in 3 per cent of 12,000 routine examinations of the shoulder. The deposits have been observed to appear and disappear spontaneously without symptoms.[27] They may also disappear spontaneously following an inflammatory episode.[27] Resorption of calcium has been repeatedly observed following roentgen therapy, but the clinical symptoms always respond to therapy before roentgenographic evidence of calcium resorption.[5] It appears, therefore, that the calcium deposits are of no particular importance in the clinical picture except in those cases which show large bone-like deposits which produce mechanical wedging between the coraco-acromial ligament and the greater tuberosity during abduction of the humerus.

The formation of the calcium deposit is usually explained on the theory of faulty oxidation in devitalized tissue. There is reduction in the formation of CO_2 locally and a consequent shift of the pH toward the alkaline side. This favors the precipitation of calcium salts, usually the carbonates and phosphates.[27] There is no generalized disturbance of calcium metabolism.[5] Conversely, the hyperemia of the inflammatory reaction will reverse this reaction, causing resorption of the calcium deposit. This process is most likely to occur with the soft putty-like deposits, while the dense bone-

like deposits probably do not resorb. Any procedure which will induce vasodilatation and hyperemia favors resorption of the calcium deposit. In confirmation of the observation of Baird,[3] and others, resorption of the calcium deposit has been observed frequently by us following roentgen therapy.

Codman,[8] and others,[11,27,28] have emphasized the importance of recognizing rupture of the supraspinatus tendon. Partial rupture of a few fibers is probably a frequent occurrence. Complete rupture is rather uncommon but is said to occur only in the presence of degenerative disease.[8]

DIAGNOSIS

The diagnosis is based on the case history and the physical examination, supplemented if possible by roentgenograms of the shoulder girdle. The record of the patient referred to the roentgen therapist is usually completed satisfactorily by the referring physician. However, it is advisable that the roentgen therapist recheck the facts, since treatment misapplied to some other lesion not only reflects unfavorably upon roentgen therapy and the statistical study of the work, but does not benefit the patient.

The presenting signs and symptoms of the lesion are pain in the shoulder and limitation of movement. The pain and disability may be of minor proportions but they are often severe to the point of incapacitation. Insomnia due to the pain is common. Some authorities[2,14] state that the signs and symptoms of the average case will subside spontaneously in from three to six months. However, the course of the disease is unpredictable, and the discomfort may be present over a period of two years.[8,17,20] It should be understood that these patients come to their physician for the immediate relief of a disability which is not trivial. The arm is held in adduction and there is point tenderness over the supraspinatus insertion. The patient may claim some association with an injury but this is often vague, especially as to the time relationship. At least two-thirds of the patients give no history of any trauma. If there has been a recent significant injury, tendon rupture, fracture or dislocation should be excluded as a cause for the disability. In such cases, a roentgen examination is essential to exclude the possibility of bone or joint damage. If tendon rupture is suspected, infiltration of the area with a local anesthetic will control the pain to a degree that will allow the examiner to make the necessary tests[7,18] for various muscle functions. Roentgen examination is recommended in all cases, since the presence of a calcium deposit is strong supportive evidence of the presence of this lesion when combined with a suggestive history and physical examination. Moreover it serves to exclude the possibility of the presence of such serious lesions as bone tumor and so on. Seventy-five per cent of the patients in this series had a roentgen examination of the shoulder girdle prior to treatment, of which two-thirds showed a calcium deposit. However, the clinical picture can be sufficiently clear to the point of certainty without a roentgen study. In the 25 per cent who did not have a roentgen examination, the therapeutic results were comparable to those of the entire series.

In addition to the roentgenographic demonstration of calcium deposits along the supraspinatus tendon and in the overlying bursa, Harrison[12] has described other positive findings which may be observed in the adjacent bone structures: (1) irregularity of trabecular structure of cortical bone in the greater tuberosity; (2) minor erosions of articular cortex; (3) loss of normal contour of the anatomical humeral neck; (4) cystic cavitation at the tendon insertion; (5) areas of local bone sclerosis.

MATERIAL

Three hundred consecutive cases treated by external roentgen irradiation form the basis of this report. These patients were referred by various physicians for treatment with the tentative diagnosis of supra-

spinatus tendinitis and were accepted as being suitable for this type of treatment. The largest number were referred from the orthopedic service and a substantial number from the medical service including cardiology. It is of interest that 28 patients in this series were known to have coronary artery disease. Ten patients were known diabetics, 5 of whom also had coronary artery insufficiency. Thirteen of this group of 28 showed a calcium deposit. Of this group having coronary artery disease, the involvement of right and left sides was about equally divided, and only 1 patient claimed to have suffered an injury. These patients showing coincident degenerative disease responded favorably to the treatment in all but 1 instance, and no direct disease correlation was evident from this study.

Thirty-one patients were known to have had some other form of treatment such as novocaine injection, diathermy, surgery, osteopathic or chiropractic manipulations. Although the therapeutic results of this group were below the general average, they have been included in the data for the entire series.

As a check on the Departmental records, a questionnaire was mailed to the patients. This resulted in a 57 per cent response which gave significant confirmatory data on relation to injury, degree and permanence of recovery and incidence of recurrence.

The degree of cooperation on the part of the patient varied considerably, particularly where follow-up was necessary over a period of time. As would be expected, a few patients did not complete the prescribed

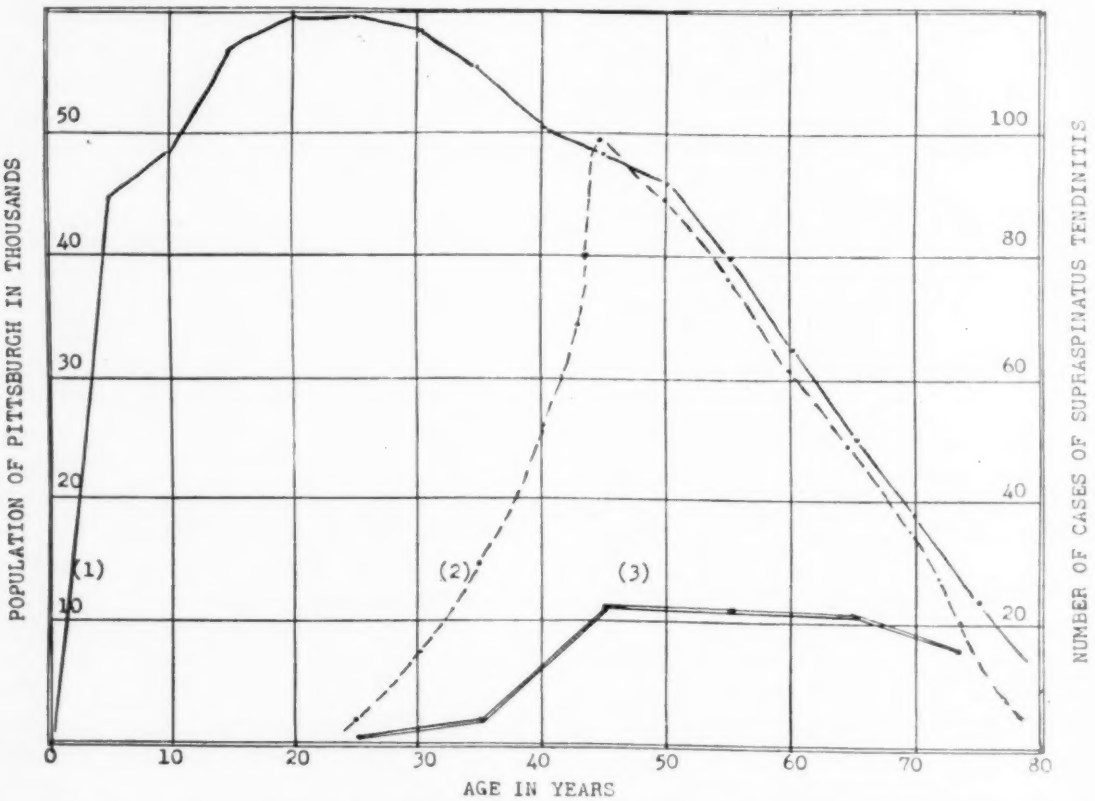

CHART I. Curve 1 represents age distribution of the Pittsburgh population in decades. Curve 2 represents the age incidence of supraspinatus tendinitis in decades. Curve 3 correlates these two and shows the number of cases per 20,000 population in each of the declining decades.

initial course of treatment or return for follow-up examination. Again, a few refused to accept additional treatment as recommended after incomplete response to the initial course of treatment. Good cooperation is necessary for consistent results, and it is probable that the therapeutic response reported would have been improved by more complete patient control. For various reasons, incomplete records ranged from 3 to 6 per cent in the entire group.

Table I

Relationship of Injury and Calcification

	Roentgenographic Evidence of Calcium	No Roentgenographic Evidence of Calcium	No Roentgenographic Examination Done	Corrected Percentage of Total Number of Cases with and without Calcium
Patients with history of injury	42	16	18	55 with calcium 72.3% with calcium 27.7% without calcium
Patients without history of injury	105	57	62	145 with calcium 64.7% with calcium 35.3% without calcium
Average age	Males 50.4 years		Females 50.6 years	
Sex incidence	Males 48.6%		Females 51.4%	
Side of lesion	Right 160	Left 140	Bilateral 27	
Rate of recurrence	39% (return of symptoms after one course of treatment)			

Correlation of the incidence of trauma and calcium deposition indicates only slightly greater chance of calcium deposition when there is antecedent injury, and showing no apparent relationship between trauma and calcium deposition. The average age of males and females is fifty years, with about equal distribution between the sexes. The right shoulder is somewhat more likely to be involved than the left. The tendency to recurrence is significant and in keeping with the irreversible nature of the primary degenerative lesion.

The sex distribution was 48.6 per cent in males and 51.4 per cent in females. The average age of the patients was practically the same for males and females being 50.4 and 50.6 years respectively. A chart of the number of cases as a function of age gave an interesting picture of approximate proportionality as to the age incidence of this disease and the age of the general population in the declining decades. It is a disease of both middle and later life (Chart I). Curve 1 represents the age incidence of the Pittsburgh population as obtained from the United States Census 1940. Curve 2 represents the age incidence of the series of 300 cases of supraspinatus tendinitis reported. Curve 3 correlates these two and represents the number of cases found per 20,000 population in each of the declining decades. The plateau of curve 3 between the ages 45–65 years is significant and represents the majority of the cases. This statistical data is contributory evidence that supraspinatus tendinitis has a degenerative basis.

Of the 300 cases studied, the right shoulder was involved 160 times, the left shoulder 140 times and both shoulders 27 times.

The relationship of injury to this condition has not been entirely settled and there is a wide difference of opinion among authorities in this respect. Howarth[13] noted that only 3 per cent of his cases had a history of injury, while at the other extreme

Harrison[12] noted that all of his cases had suffered an injury. Most authors take an intermediate view that injury may be a factor in initiating or contributing to the inflammatory phase of the disease. As the disease is primarily a degenerative change or aging process in the tendon fibers, there is no doubt that susceptibility to minor trauma or occupational strain is increased. In the present group there was a history of trauma in 25 per cent, but this was often vague and varied in the time relation from several days to several years, averaging 4.5 months prior to the onset of symptoms. In 70 per cent of the cases there was no known injury to the shoulder. The remaining 5 per cent were too indefinite in this respect to make a positive statement regarding injury.

The statistical relationship of trauma and calcium deposit was studied also (Table 1). Seventy-two per cent of the cases which had a history of injury showed a calcium deposit, while 64 per cent of those without a history of injury showed a calcium deposit. There appears to be no significant relationship, therefore, between trauma and the deposition of calcium in the shoulder area. This tends to confirm the statement of Wilson[27] that a single severe traumatic incident will not cause calcification.

Since the degeneration in the tendon fibers and the production of a variable degree of fibrosis in an aging patient are irreversible changes from a therapeutic standpoint, it is to be expected that there will be a considerable tendency to recurrence of painful attacks. Over a relatively short follow-up period, 39 per cent of cases responding favorably to initial therapy had recurrence of symptoms.

In approaching this problem therapeutically, one must recognize the general criteria governing the management of the aging individual. The older person has a much narrower margin in the tolerance of functional stresses. Reaction to injury is less marked and the healing response is progressively more limited. Therapeutically, greater caution must be exercised in the administration of drugs or radiation.

ROENTGEN THERAPY IN THE MANAGEMENT OF SUPRASPINATUS TENDINITIS

The object of the therapy is the effect produced on the inflammatory phase of the lesion and not on the degenerative process.[5] Roentgen therapy has been recognized as having a beneficial effect in resolving inflammatory processes for some time. It has been used in the treatment of supraspinatus tendinitis in Europe[10,23] and in America[1,3,5,9,15] for a considerable number of years. The effect is produced in a number of ways through the biophysical properties of the radiation. Vasodilatation is stimulated about the lesion thereby accelerating the respiratory exchange in the tissues, the removal of degenerated or toxic material and the mobilization of antibodies. The latter is accomplished in part also by the action on the white cells. Accumulations of lymphocytes choking the lymphatics are dispersed because of their extreme radiosensitivity. Edema is reduced by opening up the lymphatic drainage. It is known also that capillary and cell permeability are altered by irradiation which expedites dispersal of exudate and toxic material. Irradiation will not dissolve fibrin directly[5] or change adult scar tissue, but there is evidence to indicate that its judicious use may inhibit the growth of young fibroblastic cells. Irradiation will not dissolve a calcium deposit, but resorption of fibrin and calcium may occur indirectly as a result of the irradiation-induced hyperemia.[5] It is therefore rational to believe that the use of roentgen therapy would be valuable in accelerating resolution of the inflammatory portion of this lesion. The relief of pain within a few hours of treatment in many of the patients so treated attests to this fact.

The initial course of roentgen therapy consists of four consecutive daily applications of 150 r (measured in air without back scatter) directed to the point of maximum tenderness through a 10 by 10 cm. port at

50 cm. target skin distance with a beam generated at 200 kv. and filtered through 0.5 mm. Cu plus 1 mm. Al. It is thought that equally satisfactory or possibly better results might be obtained by using a less penetrating beam, a technique which we have adopted for use in another group of cases.

ing the use of counterirritants and various other applications on the area treated, as surprisingly intense skin reactions may be encountered due to their use in combination with the irradiation. Topical applications of any kind are not considered necessary or advisable.

Supplementary treatment exercises are

Fig. 1. Progressive resorption of an extensive calcium deposit following roentgen therapy.

The acute signs and symptoms will subside frequently with a single course of treatment, particularly in the younger individual. Following the initial course of treatment, the condition of the patient is checked in one month. If some signs and symptoms persist as may happen in the more chronic type, a further course of treatment may be advised. The average number of courses of treatment for the whole group was 1.5.

Some flexibility of technique to meet individual requirements is necessary. The more chronic type of case will receive benefit, but it is often necessary to give more than one course of treatment. In this group of chronic lesions, the daily dosage fraction was sometimes advanced to 200 r. This is contrary to the opinion of some authorities[13,16] who believe that roentgen therapy is of no avail in the chronic case.

Some aggravation of symptoms may occur following the first treatment of those patients in the acute phase of the disease, and the patient should be informed of this possibility. This is a sign that the treatment will have a beneficial effect.

The patient should be cautioned regard- recommended, particularly in the chronic type. In the acute type, exercises should be deferred for about two weeks. The restoration of muscle tone is important in obtaining the maximum range of shoulder movement.

Where surgical intervention appears indicated for relief, Watson-Jones[26] and others[2,28] advise acromionectomy in those few cases which cannot be resolved by more conservative means. This procedure may appear rather radical, but good results are reported without interference with shoulder function. It is believed that surgical excision of large bone-like deposits is indicated occasionally where there is a wedging effect between the coraco-acromial ligament and the greater tuberosity. Surgical drainage[13,27] or needling[20] to relieve the tension of the inflammatory exudate with or without a calcareous deposit would appear to be rarely, if ever, necessary.

Analysis of Therapeutic Results

In any geriatric problem, cure is a perfect ideal rarely attained. Like infinity, it is approachable but never finally reached. The advance of medical science has en-

TABLE II

RESULTS OF ROENTGEN THERAPY

	No. of Cases	A Good Result	B Fair Result	A and B Favorable	C Slight Effect	D No Effect	C and D Unfavorable	Records Incompl. etc.
Entire series from Dep't records	300 100%	139 46.3%	112 37.3%	251 83.6%	13 4.3%	25 8.3%	38 12.6%	11 3.7%
Series from questionnaire follow-up	171 57%	94 56.7%	57 33.3%	151 89%	0 0	20 11%	20 11%	0 0
Patients who had other treatment	31 10%	10 32%	13 41%	23 73%	5 17%	3 10%	8 17%	0 0
Patients with history of injury	76 25.3%	39 51.3%	26 34.2%	65 85.5%	4 5.2%	4 5.2%	8 10.4%	3 4%
Patients with no history of injury	224 70.4%	100 44.6%	79 35.2%	179 79.8%	11 4.9%	20 8.9%	31 13.8%	14 6.2%
Patients with roentgenographic calcium	152 50.6%	72 48%	57 35%	129 83%	4 3%	14 9%	18 13%	5 4%
Patients without roentgenographic calcium	72 24%	28 40%	30 41%	58 81%	4 5%	7 10%	11 15%	3 4%
Patients without roentgenographic examination	76 24.4%	39 51%	25 33%	64 84%	5 6%	4 5%	9 11%	3 5%

A favorable result from roentgen therapy is obtained in excess of 83 per cent of cases. Previous treatment of a different type notably reduces the prognosis for a favorable result. History of trauma has no significant result on effect of roentgen therapy. The presence of a calcium deposit has no significant relationship to the therapeutic result. Roentgen examination did not significantly alter the accuracy of diagnosis as those without such examination showed equally good therapeutic response.

hanced longevity, but in so doing it has permitted the survival of many with chronic illnesses. It is difficult sometimes to distinguish between the depreciations which occur in older individuals due to aging, as a pure phenomenon, and those due to scarring, repeated injuries and so on. But it should be the goal of medical management to obtain the maximum degree of well-being and usefulness.

In interpreting these results, therefore, a gradation in the degree of pain relief and improved mobility of the shoulder has been attempted. A broad classification of favorable and unfavorable results was made. The favorably affected group includes all patients who were considered to have received sufficient benefit within a period of three weeks following treatment. This group was further subdivided into those who were classified as good results, in which the patients appeared to have been completely relieved, and as fair results, in which the patients received considerable benefit but who showed some residual disturbance such as slight limitation of movement or slight discomfort associated with movement only. The unfavorably affected group consisted of those who received only slight benefit or no benefit at all.

Reference to the statistical chart (Table II) indicates favorable results in 83.6 per cent of cases from the department records, confirmed by the report of 89 per cent as obtained from the questionnaire which was sent out to the patients. The good results

were significantly larger also in the questionnaire component of the group studied. This group of patients who took the trouble to answer the questionnaire probably represents the more cooperative section of the whole series, and the best results ensue from good cooperation. The unfavorable results occurred in 12.6 per cent and 11.0 per cent respectively, indicating close confirmation of the figures.

Division of the patients into subgroups with and without history of injury showed no significant difference in therapeutic results, there being slightly better response (7 per cent) in those having a history of injury. The factor of injury, therefore, does not impair the prognosis but may slightly favor it. Similarly the presence or absence of a calcium deposit does not greatly alter the prognosis as only slightly more (8 per cent) obtained a good result when a calcium deposit was present. This agrees with the findings of Baird[3] who obtained an equally good response whether calcium was present or not. In this group the accuracy of diagnosis was higher, which may account for part of the (8 per cent) difference. These data further affirm the previous statement that calcium deposits have no relationship to the symptoms with but rare exceptions.

In the group of patients who did not have a roentgen examination to aid the diagnosis, the therapeutic result was the same as for the entire series. If the therapeutic result is proportional to the accuracy of diagnosis in any subgroup, then it is apparent that the clinical diagnosis of supraspinatus tendinitis may be accurately made without roentgen examination.

The group which received other types of treatment prior to roentgen therapy obtained justifiable therapeutic results, although considerably less favorable than that for the entire series, This group reduced the favorable statistics for the series as a whole. A similar phenomenon is shown in the roentgen therapy of malignant disease where some other type of therapy has been attempted previously.

CONCLUSION

In view of the degenerative condition of the tendon fibers underlying the inflammatory reaction, it is unlikely that any method of treatment will be entirely effective. Roentgen therapy, judiciously applied to meet the individual needs, has proved itself to be very useful in the management of nearly all cases of supraspinatus tendinitis. The beneficial results are obtained through acceleration of the resolution of the inflammatory process by the roentgen irradiation.

The role of trauma in the etiology of the condition has been discussed, and it is believed that this factor has been overemphasized in the past. The presence or absence of a calcium deposit has no prognostic significance, but its roentgenographic demonstration has some diagnostic value. Roentgenographic examination is important in excluding other serious disease in the shoulder area.

The incidence of the disease is fairly consistent throughout the latter decades of life, which is in keeping with the findings that the disease is primarily a degenerative process.

It was found that those patients who had received other types of treatment prior to roentgen therapy responded less favorably.

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REFERENCES

1. Allen, M. L. X-ray therapy in treatment of para-arthritis of shoulder. *Rocky Mountain M. J.*, 1947, *44*, 621–626
2. Armstrong, J. R. Supraspinatus syndrome. *Lancet*, 1947, *1*, 94–96.
3. Baird, L. W. Roentgen irradiation of calcareous deposits about shoulder. *Radiology*, 1941, *37*, 316–324
4. Bishop, W. A., Jr. Calcification of supraspinatus tendon; cause, pathologic picture and relation to scalenus anticus syndrome. *Arch. Surg.*, 1939, *39*, 231–246.
5. Borak, J. Tendogenetic disease and its treatment with x-rays. *New York State J. Med.*, 1945, *45*, 725–729.
6. Bosworth, B. M. Quoted by Wilson.[27]

7. BROWN, J. T. Early assessment of supraspinatus tears. *J. Bone & Joint Surg.*, 1949, *31B*, 423–425.
8. CODMAN, E. A. The Shoulder. Thomas Todd & Co., Boston, 1934.
9. DE LORIMIER, A. A. Roentgen therapy in acute para-arthritis. AM. J. ROENTGENOL. & RAD. THERAPY, 1937, *38*, 178–195.
10. ELMSLIE, R. C. Calcareous deposits in supraspinatus tendon. *Brit. J. Surg.*, 1932, *20*, 190–196
11. FERGUSON, L. K. Painful shoulder arising from lesions of subacromial bursa and supraspinatus tendon. *Ann. Surg.*, 1937, *105*, 243–256.
12. HARRISON, S. H. Painful shoulder; significance of radiographic changes in upper end of humerus. *J. Bone & Joint Surg.*, 1949, *31B*, 418–422.
13. HOWORTH, M. B. Calcification of tendon cuff of shoulder. *Surg., Gynec. & Obst.*, 1945, *80*, 337–345.
14. JONES, G. B. Painful shoulder. *J. Bone & Joint Surg.*, 1949, *31B*, 433–435.
15. KLEIN, I., and KLEMES, I. S. Treatment of peritendinitis calcarea in shoulder joint. *Radiology*, 1941, *37*, 325–330.
16. KLEIN, I. Treatment of peritendinitis calcarea of shoulder joint by roentgen irradiation. AM. J. ROENTGENOL. & RADIUM THERAPY, 1946, *56*, 366–375.
17. LIPPMANN, R. K. Frozen shoulder; periarthritis; bicipital tenosynovitis. *Arch. Surg.*, 1943, *47*, 283–296.
18. MCLAUGHLIN, H. L. Lesions of musculotendinous cuff of shoulder; differential diagnosis of rupture. *J.A.M.A.*, 1945, *128*, 563–568.
19. MOSCHOWITZ, E. Histopathology of calcification of spinatus tendons as associated with subacromial bursitis. *Am. J. M. Sc.*, 1915, *150*, 115–126.
20. NORWICH, I. Calcification of supraspinatus tendon; infiltration therapy with local anesthesia and multiple needling. *Surg., Gynec. & Obst.*, 1948, *86*, 183–191.
21. PAINTER, C. F. Quoted by Wilson.[27]
22. PAUL, L. W., and MOIR, W. W. Roentgen diagnostic aspects of chronic arthritis and bursitis. *Radiology*, 1947, *49*, 6–17.
23. SANDSTRÖM, C. Peritendinitis calcarea; common disease of middle life: its diagnosis, pathology and treatment. AM. J. ROENTGENOL. & RAD. THERAPY, 1938, *40*, 1–21.
24. SIMMONDS, F. A. Shoulder pain with particular reference to the "frozen" shoulder. *J. Bone & Joint Surg.*, 1949, *31B*, 426–432
25. SUTRO, C. J., and COHEN, L. J. Basis and treatment of calcification of tendinocapsular tissues, especially the supraspinatus tendon. *Arch. Surg.*, 1941, *42*, 1065–1071.
26. WATSON-JONES, R. Fractures and Joint Injuries. Third edition E. & S. Livingstone. Edinburgh, 1943.
27. WILSON, C. L. Lesions of supraspinatus tendon; degeneration, rupture and calcification. *Arch. Surg.*, 1943, *46*, 307–325.
28. WITHERS, R. J. W. Painful shoulder. *J. Bone & Joint Surg.*, 1949, *31B*, 414–417.

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PRACTICAL PHYSICAL ASPECTS IN THE USE OF RADIOACTIVE COBALT 60 AS A RADIUM SUBSTITUTE

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IT HAS been clearly demonstrated by Myers[7] that radioactive cobalt might theoretically be utilized as a radium substitute ($_{27}Co^{60}$, isomer with 5.3 year half-life).

If it is to achieve any great advantage over radium in this respect, it must not only be readily available and cheap, but it must be utilized according to established techniques with predictable biological results.

There are various problems that present themselves:

1. What method of shielding the beta rays should one employ?
2. What method of calculating dosage should be employed, and how is it applied?
3. What is the relative biological effect of equivalent gamma roentgen doses on normal tissues?
4. What is the relative biological effectiveness of radium and cobalt 60 from the standpoint of treating malignant tumor tissue?

It is the purpose of the present paper to elaborate on the first two problems. Experiments are now being conducted on the relative effects of cobalt 60 and radium on normal animal tissues.§ The biological effectiveness of radiocobalt 60 in the treatment of malignancies will be difficult to answer, and will require a more considerable period of observation.

Decay Scheme of Radioactive Cobalt 60. The decay scheme of the 5.3 year half-life cobalt 60 isomer has been well established[8] (Fig. 1). It will be noted that there is a beta-ray emission with a maximum energy of 0.310 mev. and a gamma-ray cascade with energies of 1.16 and 1.32 mev. respectively. The gamma rays are considerably more energetic than most of the gamma

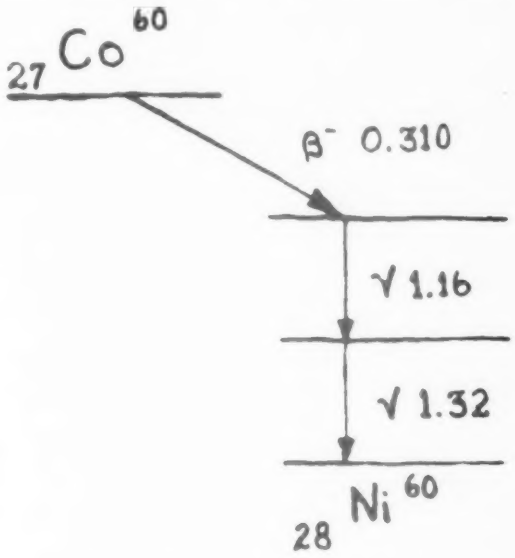

FIG. 1. Decay scheme of cobalt 60 (5.3 year half-life)

rays from radium 226, with the exception of that from radium C, which has an energy of 1.8 mev. and is minimal from the quantitative standpoint (Table 1A).[3,4] The cobalt 60 beta ray is extremely weak in comparison with the beta rays emitted from radium 226 and its radioactive descendants (maximum from radium C which emits a beta ray with 3.15 mev.).

Roentgen Equivalency of Radium and Cobalt 60. It has been generally accepted

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TABLE I (A)

URANIUM 238 DECAY SERIES—WITH THE ENERGY OF DESCENDANTS INDICATED

Element	Symbol	Half-Life	Energy of Radiation (mev.)		
			Alpha	Beta	Gamma
Uranium	92 U^{238} (UI)	4.55×10^{9} yr.	4.21		
Thorium	90 Th^{238}(UX_1)	24.1 days		0.13	0.09
Proactinium	91 Pa^{234}(UX_2)	1.14 min.		2.32	0.80
Uranium	92 U^{234} (UII)	2.69×10^{5} yr.	4.75		
Thorium (Ionium)	90 Th^{230}(Io)	8.22×10^{4} yr.	4.66		Gamma
Radium	88 Ra^{226}	1600 years	4.79		0.19
Radon	86 Rn^{222}	3.825 days	5.49		
Polonium	84 Po^{218}(RaA)	3.05 min.	5.99	Beta	
Lead	82 Pb^{214}(RaB)	26.8 min.		0.65	Gamma
Bismuth	83 Bi^{214}(RaC)	19.7 min.	5.50	3.15	1.8
Polonium	84 Po^{214}(RaC^{1})	1.5×10^{4} sec.	7.68		
Thallium	81 Tl^{210}(RaC^{11})	1.32 min.		1.80	
Lead	82 Pb^{210}(RaD)	22.2 years		0.025	0.047
Bismuth	83 Bi^{210}(RaE)	4.97 days		1.17	
Polonium	84 Po^{210}(RaF)	139 days	5.30		Gamma
Lead	82 Pb^{206}(RaG)	Stable			

TABLE I (B)[1]

GAMMA-RAY SPECTRUM OF RADIUM AND ITS EQUILIBRIUM DECAY PRODUCTS

Transition	Average Quanta per Alpha Ray of Ra n	Energy per Photon (mev.) hv	Total Photon Energy (mev.) $n\cdot hv$.	Compton Absorption Coefficient σ_a in 10^{-5} $cm.^{-1}$ std. air	$n\cdot hv\cdot\sigma_a$ 10^{-5} mev./cm. air
Ra→Rn	0.012	0.184	0.0022	3.35	0.007
RaB→RaC	0.115	0.241	0.0277	3.56	0.098
	0.258	0.294	0.0758	3.68	0.279
	0.450	0.350	0.1575	3.77	0.594
RaC→RaC′	0.658	0.607	0.4000	3.81	1.523
	0.065	0.766	0.0498	3.74	0.186
	0.067	0.933	0.0625	3.66	0.228
	0.206	1.120	0.2310	3.51	0.810
	0.063	1.238	0.0780	3.44	0.268
	0.064	1.379	0.0882	3.37	0.297
	0.258	1.761	0.4540	3.13	1.42
	0.074	2.198	0.1626	2.93	0.476
Total	2.290		1.7893 mev.		6.19

Then:

$$1\text{ gm. Ra}=\frac{(3.7\times10^{10}\times3600)}{(4\pi\times100\times100\text{ cm.}^2\text{ hr.})}\ \frac{(6.9\times10^{-5}\text{ mev./cm.})}{(6.77\times10^{4}\text{ mev./cm.}^3\cdot\text{r})}=0.969\text{ rhm}$$

Note that this numerical result is proportional to the value assumed for the absolute disintegration rate of radium. If the true value is found later to be less than 3.7×10^{10} disintegrations per second per gram radium, the expected value of rhm per gm. of radium will be reduced in proportion.

that 1 mg. of unfiltered radium in equilibrium with its decay products will produce 0.969 millioroentgens per hour at 1 meter (mrhm).[1] It has also been accepted that the equivalent of 0.5 mm. platinum (1,072.5 mg./cm.^{2}) is required to absorb all the alpha and beta particles from radium and its daughter products.[2] (This may be in error since it would require the equivalent of 1,600 mg./cm.^{2} to absorb completely the beta ray from radium C with an energy of 3.15 mev.)[3] However, an absorber of 0.5 mm. platinum or its equivalent has been found to reduce the gamma roentgens delivered so that 1 mg. of radium in equilibrium with its decay products will deliver 0.84 mrhm instead of 0.969 mrhm—the value for unfiltered radium.[1]

In contrast to the above, to absorb the weak beta rays from cobalt 60, an absorber equivalency of 85 mg./cm.^{2} is required,[3] as against the minimum value (0.5 mm. platinum) for radium 226 of 1,072.5 mg./cm.^{2} The cobalt filter to be described below is 0.23 mm./hyperchrome steel with an absorber value of 184.6 mg./cm.^{2} (This steel has a density of 8.026 grams/cc. or 8,026 mg./cc. This value multiplied by the thickness, 0.23 mm., gives one the value 184.6 mg./cm.^{2}) This filter does not diminish the gamma roentgens delivered from Co^{60} perceptibly, and hence for all practical purposes, the roentgen equivalency of cobalt 60 is the same as for the unfiltered radiations—namely 1.30 mrhm for 3.7×10^7 disintegrations per second (equivalent to 1 "millicurie").

Description of a Suitable Sheath for Co^{60} Wire. In view of the minimal absorber thickness required by the cobalt 60 beta ray, it is unnecessary to use a sheath as costly as platinum or gold. A minimal thickness of any substance which is resistant to body tissue fluids would be satisfactory. For needle application, we have found that hyperchrome steel, such as is used in hypodermic needles,* 16 gauge, is very suitable to house cobalt wire which is 1 mm. in diameter, and to shield all beta rays emitted.

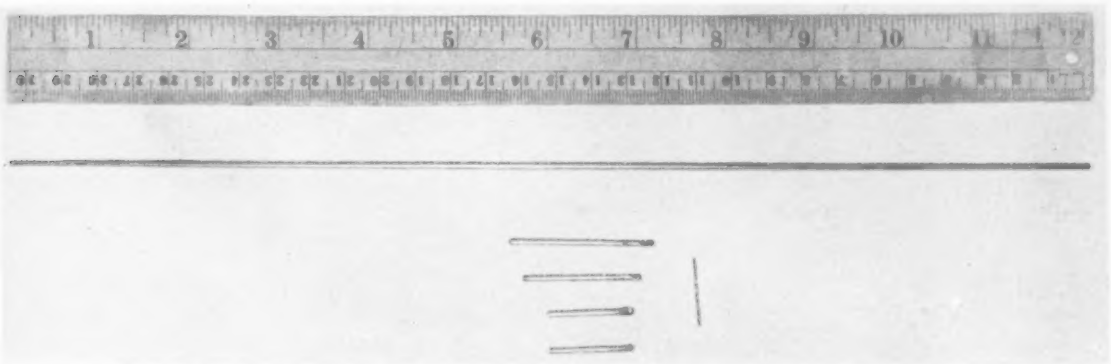

Fig. 2. Hyperchrome steel tubing—as purchased by the linear foot and converted to sheaths of any desired length.

The 16 gauge hyperchrome steel tubing has an over-all diameter of 1.65 mm., a wall thickness of 0.23 mm., and a bore of 1.19 mm. It may be purchased by the foot for as little as 65 cents per linear foot (Fig. 2). Its exact composition as given by the Becton, Dickinson Company is as follows:

Chromium	18–20 per cent
Nickel	8–11 per cent
Carbon	.08 per cent
Manganese, maximum	.02 per cent
Silicon	1.75 per cent
Sulfur	1.03 per cent
Iron	Remainder
Density	0.29 pounds per cubic inch, or 8.026 gram per cubic centimeter

* Furnished by the Becton, Dickinson Company, Rutherford, New Jersey.

The irradiated cobalt wire* utilized in these experiments, supplied by the Oak Ridge National Laboratory, was 1.0 mm. in diameter, and contained approximately 99.8 per cent cobalt and 0.2 per cent iron (Fig. 2).

The sheath for the needle was made by crushing one end of a suitable length of this tubing, and boring a hole through the crushed end to act as the eyelet (Fig. 2). In order to keep the "dead space" to a minimum, the crushed portion must not exceed 2 mm. in length, which would still permit an eyelet of 1 mm. diameter. The wire is cut so that there will be no greater "dead space" at the open end than 2 mm., and this open end is sealed with silver solder. This end may either be blunt or pointed as desired, and the needles constructed may be made of any desired length or strength.

Cobanic wire† may also be used, but since this alloy contains only 40 per cent cobalt, we have deemed it advisable in these preliminary experiments to utilize pure cobalt wire. Myers[7] has suggested that a satisfacory electroplate might be used to shield completely the beta rays from the Co^{60}. It is conceivable that the electroplate may wear away in parts, and thus would probably not be as durable over a long period of time as the hyperchrome steel.

It has been stated that pure cobalt wire must be used carefully since it may oxidize in the course of time and pulverize somewhat.[5] The use of a sheath eliminates this danger.

Since cobanic wire is only 40 per cent cobalt, it would require considerably more irradiation time in the "atomic pile" and thus would be somewhat more costly to produce.

The major cost in the preparation of these cobalt needles arises not from the radiation cost, however, but from the necessity of devising special tools and implements for loading and sealing the irradiated wire in the sheaths. In the average small machine ship, *where radioactive materials are seldom handled* (in contrast to the Oak Ridge Laboratories), a technician with no special tools or instruments could accomplish this loading process with a minimum of exposure to himself. Of course, the usual care must be exercised that every physician must exercise who handles radioactive substances in his practice, and under these circumstances, it is probable that these needles could be prepared at a cost of approximately twelve dollars per 2 cm. needle containing a total of 2 mc. of Co^{60}.‡ A similar radium needle would probably cost in the order of fifty dollars. Thus, the radiologist could acquire sufficient radioactive cobalt to implant relatively large areas with a minimum of cost to his patient.

Demonstration of Shielding Effect of the Hyperchrome Sheath. To demonstrate the effect of the sheath as an absorber of beta radiation, radioautographs of the partially shielded wire were obtained (Fig. 3). Radioautographs may also be employed in this manner to determine the beta ray leakage from the needles so constructed.

It has been stated that an absorber equivalent of 85 mg./cm.^{2} is required to filter out all the beta rays from Co^{60}.

Since the density of the hyperchrome steel employed is 8,026 mg./cc., the minimum thickness of the steel which would be necessary to filter out all the Co^{60} beta rays would be:

$$\frac{85}{8026} = 0.0106 \text{ cm. or } 0.106 \text{ mm.}$$

Since the thickness of the tubing employed in the above needles is 0.23 mm., it is more than twice the necessary thickness required for this purpose.

In order to determine whether or not this hyperchrome sheath diminished the gamma radiation from Co^{60} wire, a small

* The irradiated cobalt wire used in this investigation was supplied by the Oak Ridge National Laboratory on allocation from the Isotopes Division, U. S. Atomic Energy Commission.

† Furnished by the Wilbur B. Driver Company, Newark, New Jersey.

‡ Since our needles are being utilized in cancer treatment experiments, the irradiation in the atomic pile was furnished free of charge. It is assumed that a charge would be made in presenting these estimates.

segment of the radioactive wire was placed at a distance of 179 cm. from the end-window of a Geiger-Müller tube (window thickness 2.16 mg./cm.^{2}), first shielded and then unshielded by the 16 gauge hypodermic chrome steel tubing. No detectable difference in counts was obtained under the two conditions (experimental error approximately 2 per cent). This distance was chosen to obviate the possibility of beta particles contributing to the total counts.

Standardization of the Co^{60} Needles. A standard rated Co^{60} solution in a 5 cc. ampule was obtained from the National Bureau of Standards, Washington, D. C., and identical ampules were utilized for a solution of the unknown.

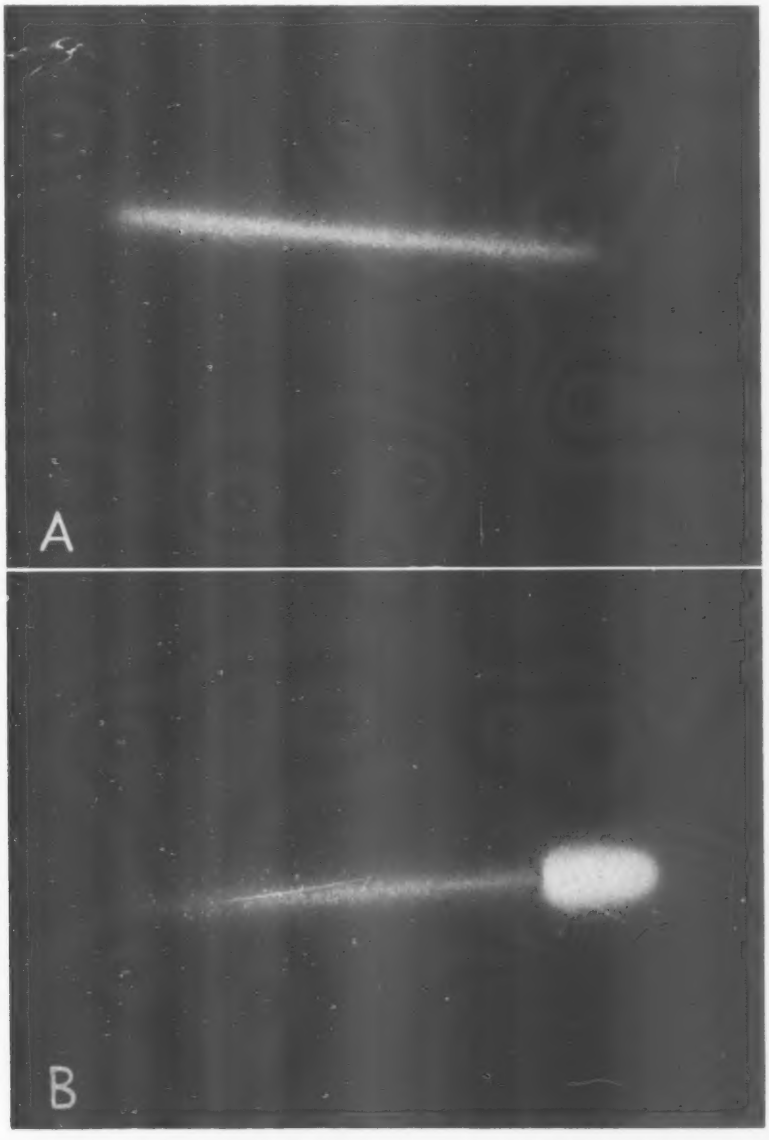

Fig. 3. Radioautographs of the partially shielded and completely shielded cobalt 60 wire. (*A*) Shielded. (*B*) Partially shielded; the partially shielded shows intensive beta radiation at one end.

The principle of the method is as follows:

(1) All of the needles are standardized (by counting at a distance from the Geiger-Müller tube) against a single radiated cobalt wire identical to those employed in the needles, and in an identical sheath. This is known as the "secondary standard."

(2) The secondary standard is then placed in solution (see technique below) and completely dissolved. The total volume is carefully noted.
(3) Five cubic centimeters of this solution or a known dilution of this solution, are then placed in an ampule identical in every respect to that furnished and rated by the National Bureau of Standards. (This standard also contains exactly 5 cc.) This ampule of the secondary standard is then sealed.
(4) The radioactivity of the secondary standard and then the primary standard are determined under identical conditions.
(5) The ratio of the activity of the primary to the secondary standard is directly proportional to the ratio of the counts obtained.
(6) The total strength of the original secondary standard solution may then be calculated.
(7) Since all of the needles were originally compared to this secondary standard, their strength may now be compared to the primary standard furnished by the National Bureau of Standards.

TABLE II

COBALT 60 NEEDLES OBTAINED FROM OAK RIDGE NATIONAL LABORATORY

No. of Needles	Linear Intensity (mc./cm.)	Length	Total Intensity (mc.)*
20	0.83	2 cm.	1.66
20	0.835	3 cm.	2.505
12	1.80	2 cm.	2.60

* 1 mc. = 3.7×10^7 disintegrations per second.

In order to dissolve the secondary standard cobalt wire, it is placed in 100 cc. of concentrated nitric acid, and heated under a hood, using "semi-hot" radiochemical technique. Ten cubic centimeters of water and acid are added alternately at about ten minute intervals. When the cobalt wire is completely dissolved, and the volume is down to approximately 25 to 50 cc., the solution is allowed to cool. This solution may then be diluted to a known desired volume, depending upon the antici-

TABLE III

MILLICURIE*-HOURS OF COBALT 60 PER 1,000 GAMMA* ROENTGENS FOR DIFFERENT AREAS, AND VARIOUS TREATING DISTANCES

(based on Paterson-Parker values for radium with 0.5 mm. platinum filter multiplied by factor 0.646)
*1 mc. = 3.7×10^7 disintegrations per second

Area sq. cm.	Treating Distances in cm. (h)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
0	19.4	77	173.2	307.5	480	693	940	1232	1558	1920
1	44	110.5								
2	62.7	137.7	242.5	386.5	558	772	1032	1321	1645	2012
3	77.6	159.7								
4	91.2	179.8	296	452	627	843	1110	1400	1722	2098
5	104	197.8								
6	114.2	215.5	346.5	505	679	908	1172	1478	1792	2170
7	124	232								
8	133	248	386.5	552	747	969	1244	1548	1862	2242
9	142.8	264								
10	152	280	424	596	798	1029	1308	1615	1930	2317
11	160.2	295								
12	168.5	310	459	638	848	1082	1363	1683	1995	2380
13	177	324.5								
14	186	338.5	493	681	895	1135	1422	1740	2058	2442
15	195	352.5								
16	201.8	365.5	526	718	943	1182	1478	1810	2120	2510
17	212	378								
18	225	391	558	756	985	1231	1530	1858	2178	2575
19	229.8	403								

TABLE III—(*continued*)

Area sq. cm.	Treating Distances in cm. (h)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
20	238	414	588	792	1026	1280	1580	1915	2238	2638
22	254	435	620	827	1068	1300	1630	1968	2292	2695
24	269.5	457	650	862	1108	1370	1680	2018	2346	2760
26	285.5	477	682	896	1142	1418	1727	2065	2408	2815
28	301	497	711	928	1180	1455	1762	2118	2460	2870
30	316.2	513	738	960	1215	1500	1816	2162	2508	2925
32	331.5	532	765	992	1250	1540	1868	2208	2560	2980
34	347	552	792	1027	1288	1580	1910	2255	2610	3040
36	360.2	568	818	1058	1300	1620	1950	2298	2662	3085
38	375.5	587	844	1090	1358	1660	1992	2342	2708	3142
40	389.5	603	870	1120	1392	1692	2035	2382	2760	3185
42	403	622	894	1150	1425	1729	2075	2430	2802	3245
44	416	640	916	1180	1457	1765	2118	2470	2860	3290
46	429.5	656	940	1210	1490	1804	2152	2512	2900	3340
48	442.5	675	962	1238	1520	1840	2192	2552	2948	3395
50	455	693	983	1265	1552	1870	2228	2590	2990	3440
52	468	710	1004	1298	1583	1908	2268	2638	3040	3485
54	480	727	1025	1323	1613	1940	2302	2670	3080	3535
56	492	746	1043	1352	1648	1970	2340	2718	3120	3580
58	505	760	1065	1380	1675	2010	2372	2755	3170	3625
60	516	780	1088	1410	1710	2042	2410	2798	3210	3670
62	528	795	1108	1438	1740	2075	2445	2830	3250	3730
64	542	814	1123	1462	1765	2110	2482	2868	3300	3760
66	552.5	832	1142	1490	1800	2140	2520	2910	3340	3815
68	564	849	1161	1515	1826	2175	2550	2948	3378	3860
70	575	866	1180	1538	1858	2205	2588	2982	3418	3898
72	586	883	1200	1565	1890	2238	2620	3020	3460	3939
74	599	900	1220	1585	1918	2270	2650	3058	3500	3980
76	610	920	1238	1610	1945	2302	2682	3098	3540	4020
78	622	934	1254	1633	1970	2338	2708	3125	3578	4060
80	634	952	1270	1658	2008	2360	2750	3165	3620	4100
84	656	985	1304	1700	2062	2425	2808	3240	3698	4180
88	680	1018	1340	1742	2120	2490	2880	3312	3762	4255
92	702	1048	1376	1788	2178	2550	2942	3382	3848	4340
96	725	1068	1412	1828	2235	2602	3002	3448	3918	4420
100	746	1110	1442	1868	2290	2662	3068	3518	3990	4497
120	844	1268	1622	2057						
140	945	1418	1800	2242						
160	1040	1560	1970	2348						
180	1130	1690	2140	2592						
200	1215	1822	2300	2770						
220	1303	1990	2458	2945						
240	1380	2067	2610	3118						
260	1458	2187	2768	3285						
280	1533	2300	2925	3462						
300	1612	2420	3075	3638						
320	1695	2538	3220	3810						
340	1768	2653	3360	3965						
360	1842	2765	3520	4125						
380	1920	2880	3635	4280						
400	1992	2985	3770	4440						

pated radioactivity of a 5 cc. sample of the solution so prepared.

An aluminum absorber of 85 mg./cm.^{2} over a Geiger-Müller tube window is utilized when the counting of the standard solutions is carried out so that the beta particles will be completely filtered out. A

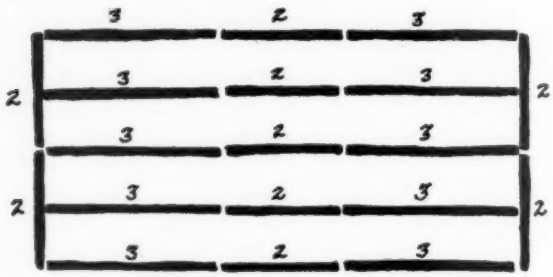

FIG. 4. Pattern of the mold employed in sample calculation.

convenient distance is employed in counting.

The standardization of needles in this manner gave values which differed only by 3 per cent from the values given by the Oak Ridge National Laboratory. Considering coincidence error and scaler efficiency, this is well within experimental error (Table II).

The stronger needles are indicated by a loop of oo surgical steel suture twisted tightly through the eyelet.

The estimated "dead space" at either end of each of these needles is in the order of 2 mm. This is considerably less than conventional radium needles where the "dead space" is usually in the order of 5 mm. at each end. The "active length" of the cobalt 60 needles is thus more nearly the actual length than is possible with radium.

Methods of Utilization and Calculation of Dosage. Paterson-Parker tables[6] and methods of implantation can be used if one makes the correction for roentgen equivalency previously established,—namely, 1.3 for cobalt 60 as against 0.84 for radium filtered by 0.5 mm. platinum.

A table (Table III) is included which has been constructed from Paterson-Parker values, so that the corrected values for cobalt 60 can be read directly.

A correction factor for the decay of cobalt 60 must also be applied from the time of its standardization till the time of its use. The decay is hardly sufficient at intervals of less than a month to be of practical significance (Table IV).

Sample Calculation for Uniplanar Implant

Problem: Prepare a mold for a rectangular area 8 by 4 cm. so that the distance of the radiation source from the lesion to be treated (h) is 0.5 cm. For how long will it be applied to deliver a total dose of 6,500 gamma roentgens to the lesion? The Co^{60} needles available are 3 cm. and 2 cm. long, and when calibrated 3 months previously were 0.83 mc. per cm.

(1) *Area of mold:* 32 sq. cm.

(2) *Pattern of mold:* (FIG. 4)
(Paterson-Parker) Pattern of the mold employed in sample calculation.
Peripheral needles all full strength
Internal needles all 2/3 strength

(3) *Total number of full-strength radiation-unit-cm:*
Periphery: 24 cm.
Internally: $24 \times 2.3 = 16$ cm.
Total: 40 cm.
(assuming no dead space and a perfect mold)

(4) *Percentage Co^{60} radioactivity remaining after 3 months* (Table IV): 96.78 per cent.

(5) *Present intensity/cm. of Co^{60} needles:*
Value in Step $4 \times 0.83 = 96.8 \times 0.83$
$= 0.803$ mc./cm.

(6) *Mc. hr. of Co^{60} required per 1,000 gamma roentgens for area 32 sq. cm. $h = 0.5$* (Table III): 331.5 mc. hr.

(7) *Total mc. hr. of Co^{60} required for 6,500 gamma roentgens:*
$6.5 \times$ value in Step $6 = 6.5 \times 331.5$
$= 2{,}155$ mc. hr.

(8) *Elongation Correction* (Paterson-Parker): 5 per cent to be added to total in Step 7: 108 mc. hr.

(9) *Corrected Total in Step 7:* 2,263 mc. hr.

(10) *Mc. hr. required for each full-strength radiation-unit-cm.:*

$$\frac{\text{Value in Step 9}}{\text{Value in Step 3}} = \frac{2{,}263}{40} = 56.57 \text{ mc. hr.}$$

(11) *Hours required for needles in periphery:*

$$\frac{\text{Value in Step 10}}{\text{Value in Step 5}} = \frac{56.57}{0.803} = 70.8 \text{ hr.}$$

(12) *Hours required for needles internally:*
$2.3 \times$ value in Step $11 = 2.3 \times 70.8 = 47.2$ hr.

(These needles would then be removed and the mold reapplied.)

TABLE IV

PERCENTAGES OF RADIOACTIVITY REMAINING IN COBALT 60 AFTER DESIGNATED INTERVALS OF TIME*

Time Yr.	Time Mo.	Per Cent Remaining	Time Yr.	Time Mo.	Per Cent Remaining	Time Yr.	Time Mo.	Per Cent Remaining
	0	100.00	3	9	61.23	9	0	30.82
	1	98.92		10	60.55		2	30.15
	2	97.83		11	59.91		4	29.50
	3	96.78	4	0	59.27		6	28.86
	4	95.73		1	58.61		8	28.24
	5	94.70		2	57.98		10	27.63
	6	93.67		3	57.35	10	0	27.03
	7	92.66		4	56.72		2	26.45
	8	91.64		5	56.11		4	25.88
	9	90.66		6	55.51		6	25.32
	10	89.68		7	54.90		8	24.78
	11	88.70		8	54.31		10	24.25
1	0	87.74		9	53.72	11	0	23.72
	1	86.80		10	53.14		2	23.21
	2	85.85		11	52.56		4	22.71
	3	84.91	5	0	52.00		6	22.22
	4	84.00		1	51.42		8	21.74
	5	83.06		2	50.87		10	21.28
	6	82.19		3	50.32	12	0	20.81
	7	81.30		4	49.77		6	19.50
	8	80.40		5	49.23	13	0	18.26
	9	79.53		6	48.71		6	17.10
	10	78.69		7	48.18	14	0	16.02
	11	77.81		8	47.65		6	15.01
2	0	76.99		9	47.14	15	0	14.06
	1	76.14		10	46.62		6	13.17
	2	75.31		11	46.12	16	0	12.33
	3	74.50	6	0	45.62		6	11.55
	4	73.70		2	44.64	17	0	10.82
	5	72.91		4	43.67		6	10.14
	6	72.11		6	42.74	18	0	9.49
	7	71.33		8	41.81		6	8.89
	8	70.55		10	40.91	19	0	8.33
	9	69.79	7	0	40.03		6	7.80
	10	69.05		2	39.16	20	0	7.31
	11	68.28		4	38.32		6	6.85
3	0	67.54		6	37.50	21	0	6.41
	1	66.81		8	36.68	22	0	5.64
	2	66.09		10	35.89	23	0	4.94
	3	65.37	8	0	35.12	24	0	4.33
	4	64.66		2	34.36	25	0	3.80
	5	63.96		4	33.62	30	0	1.98
	6	63.27		6	32.90	35	0	1.03
	7	62.57		8	32.19	40	0	0.535
	8	61.90		10	31.49	50	0	0.145

* Taken from Myers.

In similar fashion, the Paterson-Parker methods can be utilized for multiplanar, cylindrical, and other type implants.[6]

Note of Caution. A satisfactory method of utilization of cobalt 60 as a radium substitute in interstitial implants has been

described. However, until we are more certain about the relative biological effect of cobalt 60 as against other more standardized methods such as radium it would be well to regard its use as purely experimental. It has been well established that the doses for various qualities of radiation differ considerably. There may be some parallel between the biological effectiveness of radiation in tumor therapy and the erythema dose, although a direct ratio has never been established. For gamma-ray energies as different as those of radium and cobalt 60—at least until we have more information about the comparative biological effects of radium and cobalt 60 in tissues—it would be well to refrain from using the above described methods except experimentally.

Such experiments are now in progress in this laboratory and these results will be published at a later date, when they are more definitely established.

SUMMARY

1. A discussion of the gamma roentgen equivalency of radium and cobalt 60 is presented, and it is indicated that for practical purposes with a thin filter for the cobalt 60 (such as 0.23 mm. hyperchrome steel) the ratio is:

Cobalt: Radium equals 1.3:0.84
K = 0.646

This ratio has been applied to Paterson-Parker charts for utilization of these established methods and these new graphs have been presented. (Paterson-Parker value × 0.646 = Co^{60} roentgen equivalent.)

2. A cheap, stable, readily available method for encasing pure cobalt wire has been devised, which utilizes hyperchrome steel tubing, 16 gauge, for the 1.0 mm. wire. The wall thickness is more than twice that necessary for filtration of the weak beta rays from cobalt 60, and yet is not sufficient to diminish the gamma intensity. This tubing is readily made into needles, and is resistant to body tissue fluids. In rabbits, there is no significant reaction to, these hyperchrome tubes *per se*. These cobalt 60 needles may be constructed at a fraction of the cost of "equivalent" radium needles.

3. A method of standardization of cobalt needles against a National Bureau of Standards ampule of cobalt 60 is presented.

4. A sample calculation with corrected Paterson-Parker chart for use with cobalt 60 is appended.

5. Until such time as cobalt 60 radiation has been biologically standardized against radium, it is suggested that it be used only experimentally.

ACKNOWLEDGMENT

This project was originally conceived in collaboration with Dr. H. L. Friedell, Western Reserve University, School of Medicine, Cleveland, Ohio. Due to pressing duties elsewhere, Dr. Friedell was unable to continue with this project.

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REFERENCES

1. EVANS, R. D. Radioactivity units and standards. *Nucleonics*, 1947, *1*, 32–43.
2. GLASSER, O., QUIMBY, E. H., TAYLOR, L. S., and WEATHERWAX, J. L. Physical Foundations of Radiology. Paul B. Hoeber, Inc., New York, 1944.
3. GLENDENIN, L. E. Determination of energy of beta particles and photons by absorption. *Nucleonics*, 1948, *2*, 12–32.
4. LAPP, R. E., and ANDREWS, H. L. Nuclear Radiation Physics. Prentice-Hall, Inc., New York, 1948.
5. LAUGH, S. A. Isotopes Division, Atomic Energy Commission. Personal communication.
6. MEREDITH, W. J., Editor. Radium Dosage: The Manchester System. E. & S. Livingstone, Edinburgh, 1947.
7. MYERS, W. G. Applications of artificially radioactive isotopes in therapy. I. $Cobalt^{60}$. AM. J. ROENTGENOL. & RAD. THERAPY, 1948, *60*, 816–823.
8. SEABORG, G. T., and PERLMAN, I. Table of isotopes. *Rev. Mod. Phys.*, 1948, *20*, 585.

Vol. 65, No. 2

THE EFFECT OF VARIATION IN DOSAGE RATE OF ROENTGEN RAYS ON SURVIVAL IN YOUNG BIRDS*

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INTRODUCTION

MOST of the effects produced by ionizing radiations have been shown to be independent of the dose rate. In some instances, however, the duration of exposure has been reported to determine, within certain limits, the amount of damage. For example, it has been shown that increasing the dose rate up to about 10 r per minute increased the biological effectiveness of the radiation dose for inhibition of mitosis in tissue culture,[6] amount of cell degeneration in the frog tadpole,[1] and death of chick embryos.[4] In each of these instances, increasing the rate above 10 r /minute produced no further increase in the effect. Recently, Jacquez and Karnofsky[3] found that in newly hatched chicks the time of death following exposure to partially lethal doses of roentgen rays was influenced by the dose rate. The chicks began to die at about one week after exposure to 1,000 r delivered at a rate of less than 10 r/minute, but when the same dose was delivered at a rate of 15 r/minute or more, most of the chicks died within twenty-four hours. Most of those that survived beyond two to three days died at about one week.

Death immediately following irradiation occurs in the adult of most vertebrates only after exposure to extremely high doses that are delivered at high rates. However, death of adult rabbits and young chickens during the first twenty-four hours after total body exposure to partially lethal doses of roentgen rays has been reported in the earlier work in this laboratory.[5] In all cases the rate of exposure was about 15 r/minute.

The experiments reported here were planned to confirm the effect of variation in dose rate on survival following roentgen irradiation of newly hatched chicks. Comparisons were made with the effects of variation in dose rate on survival of one and two week chicks. Experiments were repeated on newly hatched ducklings to determine whether or not the dose rate effect was limited to chickens.

MATERIALS AND METHODS

Unsexed white leghorn chicks and mammoth white pekin ducks were received one to two days after hatching. On the basis of age at time of irradiation, the chicks were divided into three groups: (1) newly hatched (irradiated two to three days after hatching); (2) one week (irradiated at seven to nine days after hatching), and (3) two week (irradiated at fourteen to fifteen days after hatching). The ducklings were irradiated only at two to three days after hatching. From 30 to 180 chicks were included in each of the exposure groups. In the ducklings, exposure groups were represented by somewhat smaller numbers. All roentgen-ray exposures were single dose delivered to the total body. Routinely, survival was observed for only two weeks, for early results indicated no irradiation deaths occurred after this time.

Conditions of irradiation were: 200 kv., 15 ma., and 0.5 mm. Cu and 3.0 mm. bakelite filters. Different dose rates were obtained by varying the target-field distance. Although a range of rates from 6 r to 43 r/minute was tested, little or no change in effects was obtained when the rate was increased above about 15 r/minute. The high rate was therefore standardized at 43 r/minute as the shorter exposure time made possible a larger number of exposures. A target-field distance of about 46 inches gave a dose rate of 6.0 ± 0.1 r/minute, and a distance of 18 inches gave a dose rate of 43.3 ± 1.5 r/minute.

RESULTS

Two to three day chicks were exposed to

* From the Biology Division of the Argonne National Laboratory, Chicago, Illinois.

600 r, 800 r, 1,000 r, and 1,200 r at 6 r and 43 r/minute. Exposure at the lower rate was followed by only a small number of deaths until three to five days after irradiation, and the death rate was highest between five and ten days. Exposure to 1,000 r and 1,200 r at the higher rate resulted in 75 per cent and 90 per cent mortality, respectively, within twenty-four hours and only a small number of deaths occurred during the next two weeks. After exposure to 600 r and 800 r at the higher rate only 2 per cent and 22 per cent mortality, respectively, occurred during the same period, and the death rate was relatively constant during the two week period of observation (Fig. 1). Comparison of total mortality at fourteen days shows that the different rates of exposure produced no significant difference in the two groups exposed to 600 r ($p > 0.05$) but that a significant difference did exist between the high and low rate groups exposed to 800 r, 1,000 r, and 1,200 r ($p = 0.001$).

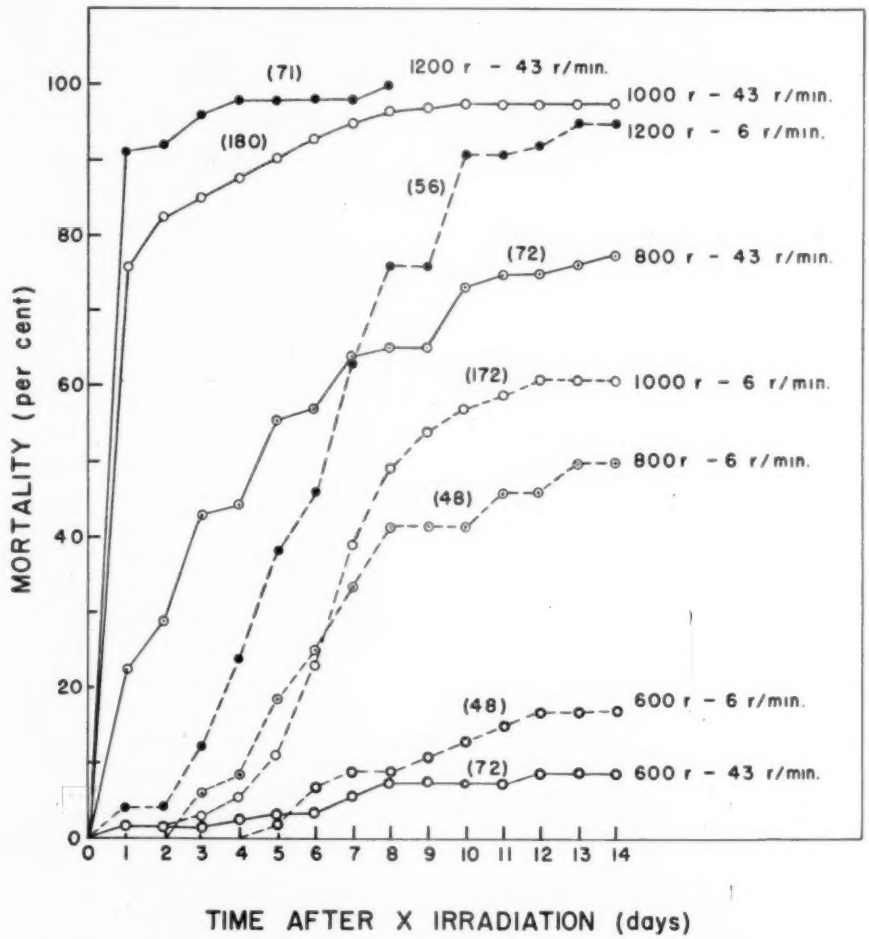

FIG. 1. Per cent mortality of two to three day chicks following roentgen irradiation. The numbers in parentheses indicate number of animals represented by each line.

Two to three day ducklings were exposed to 600 r, 900 r, and 1,200 r at 6 r and 43 r/minute (Fig. 2). During the first day after exposure at the higher rate, the mortality was 6 per cent after 600 r, 80 per cent after 900 r, and 100 per cent after 1,200 r. No further deaths occurred in animals exposed at the higher rate until

nine to eleven days, when the remaining birds that had been exposed to 900 r died and the number of deaths in those exposed to 600 r increased to 32 per cent. Animals exposed at the lower rate began to die after five days, and the death rate was highest at seven to nine days. Comparison with results obtained on chicks indicates that the two species reacted in a similar manner. The sharp break in the curves in Figure 2 (ducklings) was in part the result of the small number of animals represented.

Chicks were irradiated at one and two weeks of age to determine whether the development after hatching resulted in any change in the effect of variation in dose rate. In chicks exposed at seven to nine days after hatching, there was little difference in the shape of the survival curve after exposure at 6 r or 43 r/minute but the mortality at fourteen days was greater in groups exposed at the higher rate (Fig. 3). Most deaths occurred within twenty-four hours after exposures to doses from 700 r to 1,000 r, and there were no deaths during the five to ten day period after irradiation except in the group exposed to 700 r and 800 r at 6 r/minute. The survival in groups exposed at two weeks after hatching was intermediate between that seen in two day and in seven day chicks. The sensitivity to exposure at 43 r/minute

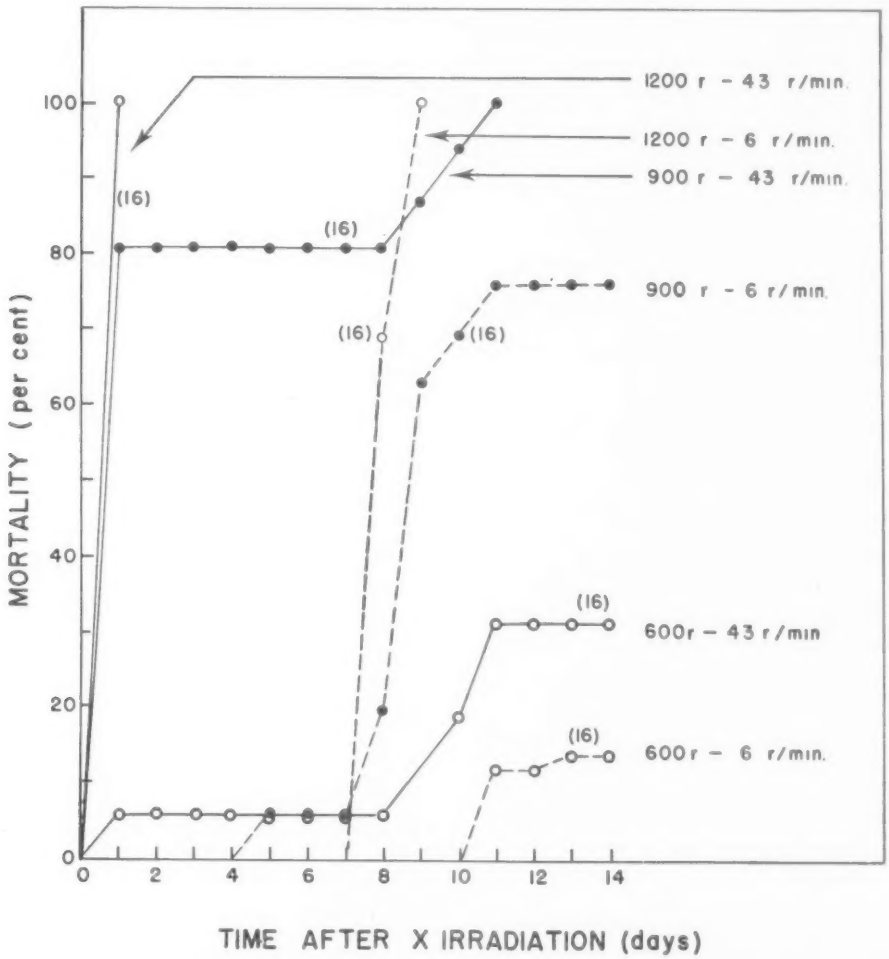

Fig. 2. Per cent mortality of two to three day ducklings following roentgen irradiation. The numbers in parentheses indicate number of animals represented by each line.

was less than that seen in one week chicks, but the shape of the survival curve was the same. Exposure at 6 r/minute, however, resulted in a relatively uniform death rate (Fig. 4). A small per cent of deaths occurred during the first day, and the mortality rate was quite constant during the two week period of observation.

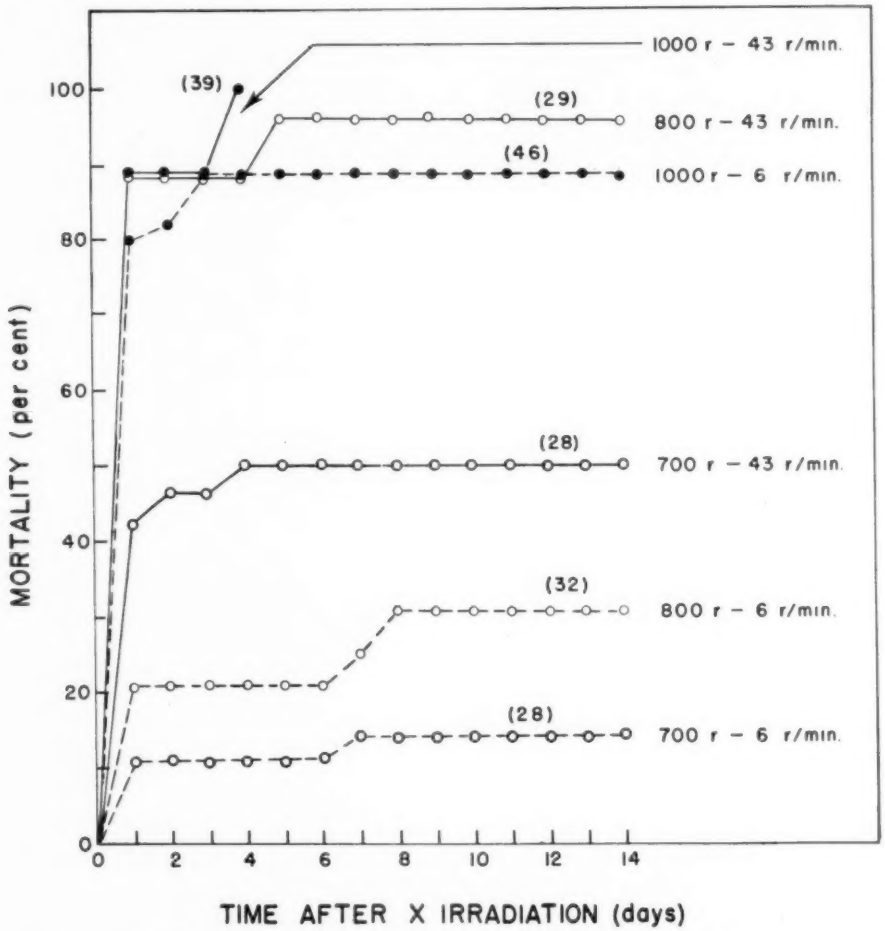

FIG. 3. Per cent mortality of seven to nine day chicks following roentgen irradiation. The numbers in parentheses indicate the number of animals represented by each line.

The immediate causes of early deaths following irradiation in birds are obscure. Gross autopsy findings in chicks dying six to twenty-four hours after exposure to 1,000 r at 43 r/minute included jaundice, edema and hyperemia (especially of the viscera), and, in some cases, ascites. Multiple diffuse hemorrhages were commonly seen, especially in the liver, kidneys, and proventriculus. A marked lymphopenia and a granulocytosis were present at three hours after irradiation. A hemoconcentration was indicated by an increase in hematocrit values and a polycythemia at three to six hours after exposure, and both conditions were most marked in moribund animals. Studies of histopathologic changes are not yet completed.

DISCUSSION

In newly hatched chicks and ducklings, the time of death following irradiation has been shown to be largely dependent on the dosage rate. These species are members of different taxonomic families

and are not considered to have a close phylogenetic relationship. It seems quite possible, therefore, that mechanisms responsible for the early deaths and for the dosage rate effect are common to all birds. As yet there have been no reports of a dosage rate effect upon survival in members of other classes of vertebrates.

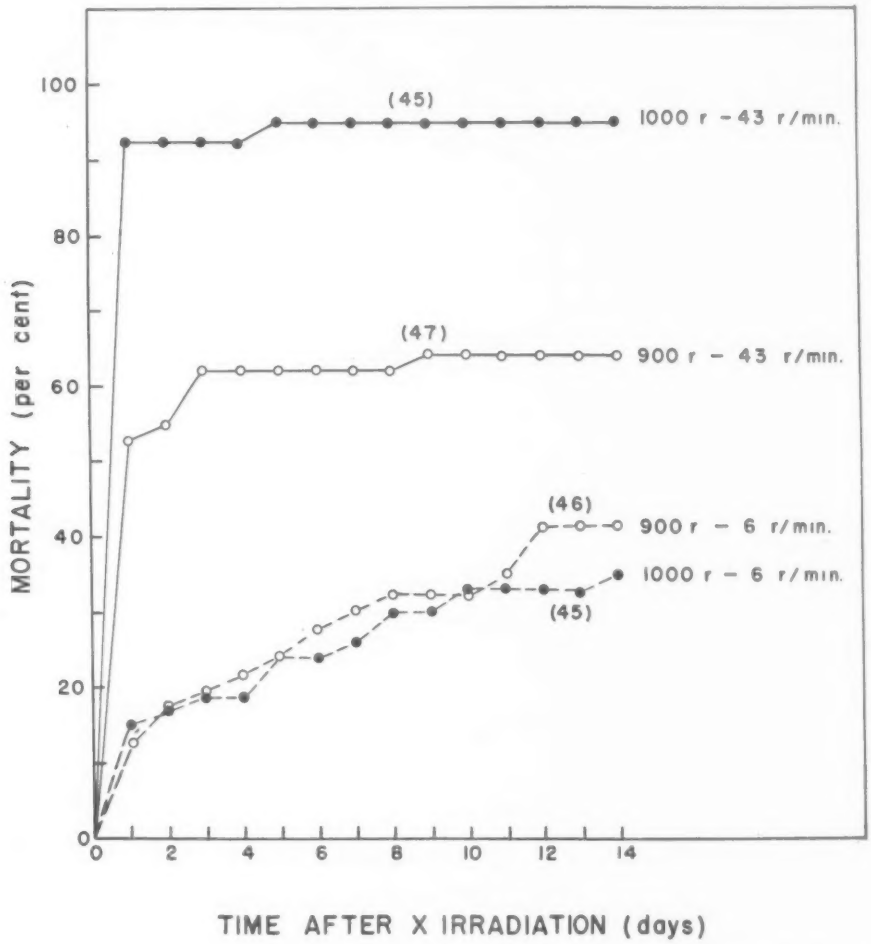

Fig. 4. Per cent mortality of fourteen to fifteen day chicks following roentgen irradiation. The numbers in parentheses indicate the number of animals represented by each line.

Following irradiation of young chicks and ducklings, the mortality rate was greatest during two periods—the initial period, within one to two days after exposure, and the period of "acute deaths," between five and ten days after exposure. In chicks, there were some deaths in the interval between the two periods of maximum number of deaths, but in ducklings the two periods of greatest mortality were more discrete and no deaths occurred between one and five days after exposure to 600 r, 900 r, and 1,200 r roentgen radiation.

Deaths that occurred in the initial period (within twenty-four to forty-eight hours) may be assumed to have resulted from different mechanisms than those that led to death at about one week after exposure to roentgen rays. The so-called "acute radiation death," reported for all mammalian species studied, has been shown to follow a sequence of events (e.g., atrophy of blood-forming tissues, leukopenia, and lympho-

penia) which requires several days for completion.[5] On the other hand, the edema and shock-like state seen in the initial deaths may be similar to parts of the terminal picture characteristic of deaths following exposure to massive dosages.[2] These conditions are not part of the terminal picture of "acute radiation deaths" in chicks.

The dependence of death upon dosage rate suggests that the lethal changes responsible for these deaths may be recoverable. If the radiation is given over a three hour period, but fractionated into two or more exposures and given at the higher rate, results are comparable to those that follow low rate exposures. Lea[4] has postulated that death of chick embryos in the initial period following irradiation resulted from accumulation of harmful chemicals in in the cells. If these substances are being removed with a rate constant of the same order of magnitude as the duration of irradiation, then it is clear that the peak concentration would be higher with the higher irradiation rate.

The influence of age on survival following irradiation is interesting. The most striking effects of dosage rate are seen in the two to three day group. The one week chicks were most sensitive during the initial period whether irradiated at the high or low rate, but mortality over the fourteen day period shows that the LD_{50} is no greater than in newly hatched chicks (Table 1). The effect of dosage rate upon survival in two week chicks appears to be intermediate between that of the two younger groups. In the case of the newly hatched ducklings, the division between early and late deaths seems to be more distinct than in the chicks.

The mechanisms leading to death in the initial period remain to be elucidated by further work. The rapidity with which death follows roentgen irradiation suggests that vascular or neurological injury must be seriously considered as contributing factors.

TABLE I

COMPARISON OF THE SENSITIVITY TO ROENTGEN IRRADIATION OF THE THREE AGE GROUPS OF CHICKS

Age	LD_{50}/4 days		LD_{50}/14 days	
	43 r/min.	6 r/min.	43 r/min.	6 r/min.
2–3 days	900–1000 r	>1200 r	600–800 r	800 r
1 week	600– 800 r	900–1000 r	700 r	900–1000 r
2 weeks	<900 r	>1000 r	<900 r	>1000 r

SUMMARY

Survival following roentgen irradiation of young birds depended on total dose, dose rate at which the exposure was made, and age at the time of exposure. Exposure of two to three day chicks to 1,000 r at a rate of 15 r/minute or more resulted in 75 per cent mortality within twenty-four hours. Exposure to the same dose at 6 r/minute resulted in only one per cent mortality within twenty-four hours, and 46 per cent occurred between five and ten days after irradiation. When one week chicks were exposed to the same dose, the largest number of deaths occurred during the first twenty-four hours, whether the rate was 6 r or 43 r/minute. Irradiation of two week chicks also resulted in a large percentage of early deaths after exposure at the high rate but a low rate of death after exposure at the low rate. Two to three day ducklings showed the same reaction to irradiation as was seen in chicks, suggesting that the dose rate effect on survival may be characteristic of the entire avian class.

The mechanisms leading to the early deaths are not clearly understood. It is suggested that the biological effects of variation in dose rate indicates recovery is taking place during an exposure at the low rate so that the total effect of the dose is less than if it were given at a high rate.

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REFERENCES

1. Glücksmann, A., Tansley, K., and Wilson, C. W. Effect of variations in dose-rate of gamma radiation on cell degeneration in frog tadpole. *Brit. J. Radiol.*, 1945, *18*, 158–164.
2. Henshaw, P. S. Experimental roentgen injury. III. Tissue and cellular changes brought about with single massive doses of radiation. *J. Nat. Cancer Inst.*, 1944, *4*, 503–512.
3. Jacquez, J. A., and Karnofsky, D. A. Toxicity and pathological effects of roentgen rays in the chicken. Am. J. Roentgenol. & Rad. Therapy, 1950, *64*, 289–297.
4. Lea, D. E. Dependence of biological effect of radiation on intensity and wave length as measured by delayed lethal action on chick embryos. Am. J. Roentgenol. & Rad. Therapy, 1941, *45*, 605–613.
5. Prosser, C. L., *et al.* Clinical sequence of physiological effects of ionizing radiations in animals. National Nuclear Energy Series (mpts), Div. IV, 1946, 22b.
6. Spear, F. G., and Grimmett, L. G. Biological response to gamma rays of radium as a function of intensity of radiation. *Brit. J. Radiol.*, 1933, *6*, 387–403.

THE EFFECT OF OVER-ALL TIME OF EXPOSURE UPON SURVIVAL OF YOUNG CHICKS FOLLOWING ROENTGEN IRRADIATION*

By S. PHYLLIS STEARNER *and* EMILY J. B. CHRISTIAN
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INTRODUCTION

RECENT experiments have shown that the survival of young birds following exposure to roentgen rays is influenced by the dosage rate.[1,4] Exposure of newly hatched chicks and ducklings to about 1,000 r at dosage rates above 10 to 15 r/minute resulted in 75 to 80 per cent mortality in the initial period (twenty-four to forty-eight hours) after irradiation, but exposure to the same dosage at rates below 10 r/minute produced only a few deaths until five to seven days. Actually, these results do not make it possible to distinguish between the effects of dosage rate and of over-all treatment time, since varying the rate necessitated varying the exposure time when the total dose was kept constant. Paterson and Thompson[3] are of the opinion, based on results of irradiation of tissue cultures, that the number of fractions and the fractionation interval are of greater importance than dosage rate as such in determining the the effectiveness of a radiation dosage.

Fractionated dosages have been used to determine the relative influence of dosage rate and of over-all time. In this way it was possible to vary the over-all time and maintain a constant dosage rate. The lethality of dosages delivered in two and in four fractions will be compared with that of continuous exposures (all delivered in the same over-all time).

MATERIALS AND METHODS

Unsexed white leghorn chicks were irradiated two to four days after hatching and survival was observed for two weeks. In all cases the total roentgen-ray dosage was 1,000 r but exposures were made at rates of 6 r, 11.5 r, 18.5 r, and 43 r/minute. Exposures at 43 r/minute were either continuous or divided into 2 or 4 fractions, but all exposures at the lower rates were continuous. The arrangement of dosage rates and the spacing of exposures are shown in Table 1. From 30 to 90 animals were included in each exposure group.

TABLE I

ARRANGEMENT OF DOSAGE RATES AND SPACING OF EXPOSURES

Total Time	Number of Exposures	Duration of Intervals	Dosage Rate
(minutes)			(r/minute)
23.3	1	—	43
54.0	2	30 min.	43
54.0	4	10 min. (×3)	43
54.0	1	—	18.5
84.0	2	60 min.	43
84.0	4	20 min. (×3)	43
84.0	1	—	11.5
166	2	142 min.	43
165	4	47 min. (×3)	43
166	1	—	6

The physical conditions of irradiation were as follows: 200 kv., 15 ma., and 0.5 mm. Cu and 3.0 mm. bakelite filters. Different dosage rates were obtained by varying the target-field distance.

RESULTS

The effect of over-all time of the exposure upon survival following 1,000 r roentgen radiation (rate of 43 r/minute in all cases) is shown in Figure 1. In each instance, increasing the total exposure time increased the survival, but not at a propor-

* From the Biology Division of the Argonne National Laboratory, Chicago, Illinois.

tional rate. A decrease in over-all time from 166 to eighty-four minutes caused only a slight increase in mortality but when the total time was decreased from eighty-four to fifty-four minutes, there was a threefold increase in mortality at fourteen days, and deaths within twenty-four hours after exposure increased from 4 per cent to 65 per cent. The decrease in over-all time from 166 to eighty-four to fifty-four minutes represented an increase in average rate from 6 r to 12 r to 18.5 r/minute.

Survival following 1,000 r at 43 r/minute fractionated into two and into four exposures is graphed in Figure 2. When the over-all time of exposure was held constant (1,000 r in 166, 84, or 54 minutes), a dosage divided into two fractions resulted in better survival than did the same total dosage divided into four fractions (given at 43 r/minute) or given in one continuous exposure at a lower dosage rate. In addition, of the groups exposed at average rates of 6 r and 11.5 r/minute, both fractionated exposure groups showed better survival than did the groups exposed continuously, although the exposure rate of the fractionated dosages was 43 r/minute. In groups exposed at an average rate of 18.5 r/minute, however, mortality was high during the initial period after irradiation and there was little difference between the survival of fractionated and continuous exposure groups. The mortality in groups exposed to fractionated and continuous dosages at an average rate of 12 r/minute was only slightly greater than that of groups exposed at an average rate of 6 r/minute (although the total exposure time was only half as long) and mortality during the initial period was low (compare Figure 2*A* and *B*).

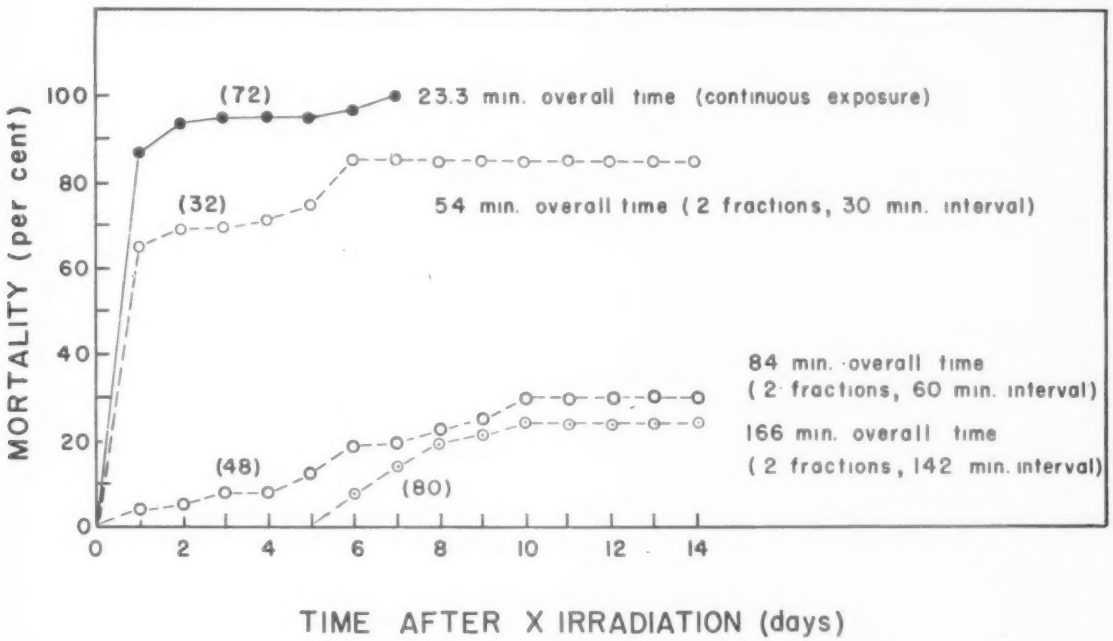

Fig. 1. Effect of over-all time of exposure on survival following 1,000 r roentgen irradiation (rate = 43 r/minute). The number of animals in each group is indicated in parentheses.
166 minute over-all time = 6 r/minute average rate.
84 minute over-all time = 12 r/minute average rate.
54 minute over-all time = 18.5 r/minute average rate.
23.2 minute over-all time = 43 r/minute average rate.

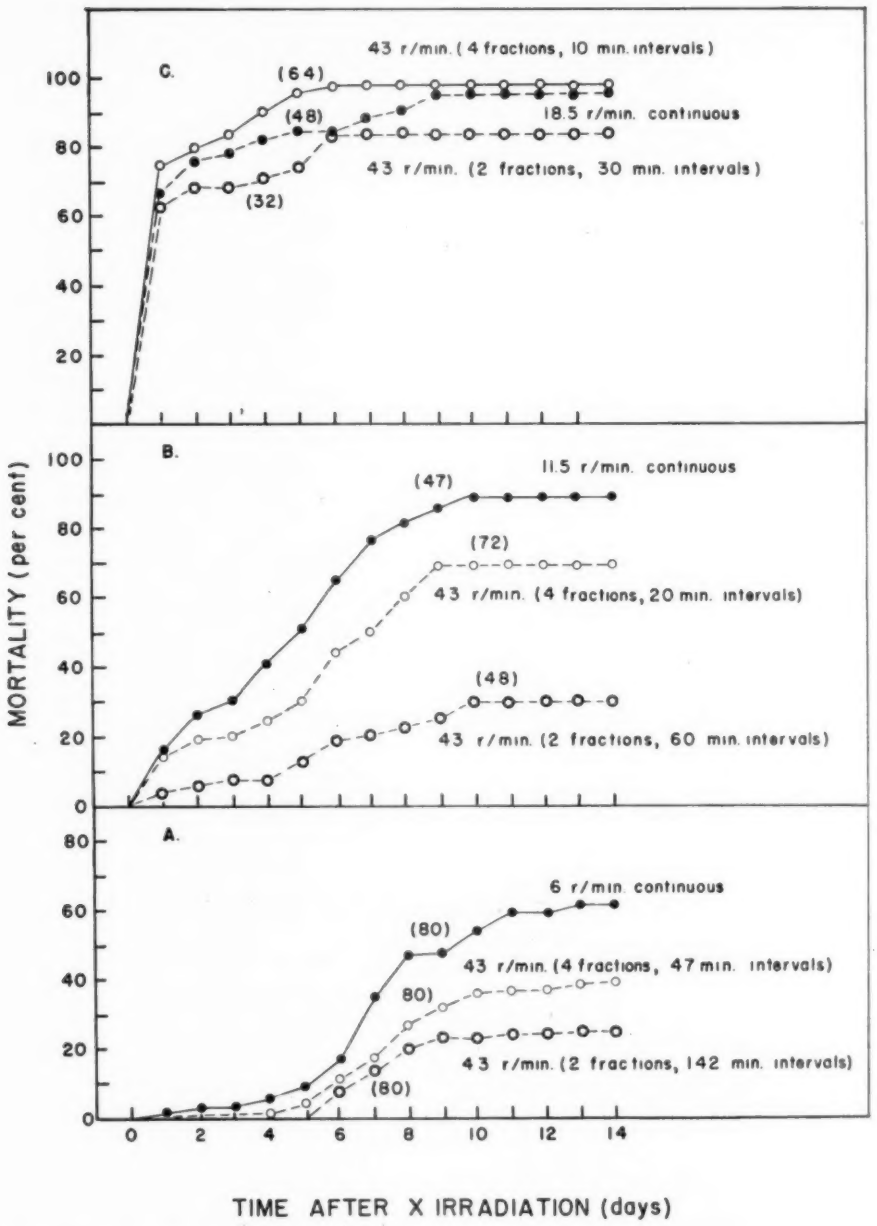

FIG. 2. Effect of dosage rate and of fractionation on survival following 1,000 r roentgen irradiation (over-all time constant). (*A*) 166 minute over-all time; (*B*) 84 minute over-all time; (*C*) 54 minute over-all time. The number of animals in each group is indicated in parentheses.

DISCUSSION

In several different species of mammals it has been shown that the lethal effects of total body roentgen irradiation are decreased by fractionation of the total dosage into a number of daily exposures. Some recovery apparently occurs during the intervals between exposures so that the toxicity of the total dosage is less than that of an uninterrupted exposure. In radiation therapy it has been generally recognized that an increase in the over-all time of exposure results in a decrease in the amount of tumor regression produced by a given dosage, but here the results are somewhat less definite.

In newly hatched birds, in which survival following roentgen irradiation has been demonstrated to depend upon dosage rate, the effects of exposure to fractionated dosages indicate that over-all time is of greater importance than dosage rate in determining the lethality of roentgen rays. Survival was increased as the over-all time of exposure was increased, although all fractionated exposures were at a high dosage rate (43 r/minute). However, the increase in survival was not proportional to the increase in over-all time, but was determined primarily by the *average* dosage rate. A large number of deaths occurred in the initial period (twenty-four to forty-eight hours after exposure) in groups exposed to fractionated dosages (two fractions) at an average rate of 18.5 r/minute, and survival was similar to that seen in groups exposed continuously at 18.5 r or 43 r/minute. Exposures to fractionated dosages at an average rate of 12 r/minute produced only a small number of deaths during the initial period and the shape of the survival curve resembled that seen in groups exposed at an average rate of 6 r/minute (either continuous exposure or fractionated dosage delivered at 43 r/minute).

When the over-all exposure time was held constant (1,000 r in 54, 84, or 166 minutes), the highest mortality for each over-all time followed the continuous dosage, indicating that recovery processes operated more efficiently in the interval between exposures than during the exposures. Moreover, a lower mortality resulted from the administration of the total dosage in two fractions than resulted from division of the same dosage into four fractions, although the total time of the three intervals in the four fractionated dosage group was equivalent to that of the single interval in the two fractionated dosage group. These results indicate that the rate of recovery following roentgen irradiation may not be a linear function, but may increase with time after exposure. In such a manner the amount of recovery during one long interval would be greater than the total amount that would accumulate during three intervals of one-third the length.

These results (decrease in effectiveness with increase in over-all time) are at variance with those produced by irradiation of fibroblasts in tissue culture (Paterson[2]). It was found that an increase in over-all time increased the effectiveness of the radiation dosage. However, the fibroblast cultures were irradiated with much larger dosages (8,000 r to 20,000 r) than those that have been used on entire organisms (1,000 r or less), and death of the cultures was assumed to be the direct result of nuclear changes. It may be assumed that the mechanisms leading to death in the intact organism are of a more complex and perhaps different nature.

SUMMARY

Survival following exposure to fractionated roentgen-ray dosages indicates that over-all time is of greater importance than dosage rate in determining the lethality of a given dosage for newly hatched chicks. Survival is increased as the over-all time of exposure is increased, but not at a proportional rate. Survival following continuous or fractionated dosages at an average rate of 11.5 r/minute resembled that which followed low rate exposures, while survival after continuous or fractionated dosages at an average rate of 18.5 r/minute was characteristic of that seen after continuous exposures at 43 r/minute.

When the over-all exposure time was held constant (1,000 r in 54, 84, or 166 minutes), the highest mortality for each over-all time followed continuous dosage, and the lowest mortality resulted from the administration of two dosages of 500 r each given at a high rate at the beginning and end of the interval. Fractionation into four dosages gave an intermediate mortality. These results may be taken to indicate that recovery does not occur at a linear rate.

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REFERENCES

1. JACQUEZ, J. A., and KARNOFSKY, D. A. Toxicity and pathological effects of roentgen rays in the chicken. AM. J. ROENTGENOL. & RAD. THERAPY, 1950, *64*, 289–297.
2. PATERSON, EDITH. Time-intensity factor in x-ray irradiation. *Brit. J. Radiol.*, 1944, *17*, 26–30.
3. PATERSON, EDITH, and THOMPSON, M. V. Time-intensity factors in x-irradiation. *Brit. J. Radiol.*, 1948, *21*, 414–419.
4. STEARNER, S. PHYLLIS. Effect of variation in dosage rate of roentgen rays on survival in young birds. AM. J. ROENTGENOL. & RAD. THERAPY, February, 1951, *65*, 265–271.

Vol. 65, No. 2

DEPARTMENT OF TECHNIQUE

Department Editor: Robert B. Taft, M.D., B.S., M.A., 103 Rutledge Ave. Charleston, S. C.

PANTOPAQUE-GELFOAM METHOD FOR THE ROENTGEN VISUALIZATION OF THE PLANE OF LOBOTOMY*

By JOSEPH F. DORSEY, M.D., *and* PAUL J. CENTNER, M.D.
BOSTON, MASSACHUSETTS

WE HAVE recently developed what we consider to be a superior technique for the roentgen visualization of the areas of section in prefrontal lobotomy. Various means have been used to show the plane of sectioning: silver clips, wires, and lipiodol[1] injected into the tract of sectioning. Silver clips and wires do not give even a bare outline of the tract sectioned. Lipiodol tends to diffuse out into the subarachnoid space or into the lateral ventricle. Recently Whitcomb and Scoville[2] have insufflated tantalum powder into the tract of section for roentgen visualization.

A new method for marking the plane of section makes use of gelfoam strips soaked with pantopaque which are then inserted into the area sectioned. This method has several advantages: The gelfoam absorbs the pantopaque and prevents leakage of the pantopaque into the subarachnoid space

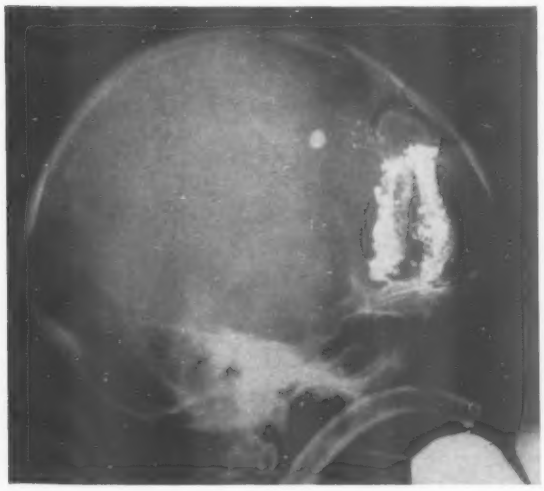

Fig. 1. Lateral view showing pantopaque-gelfoam strips in position.

Fig. 2. Anteroposterior view showing pantopaque-gelfoam strips in position.

* From the Department of Surgery, Tufts College Medical School, and the Neurosurgical Service, St. Elizabeth's Hospital, Boston, Massachusetts.

or into the lateral ventricle, should the tip of the ventricle have been entered at operation. The pantopaque saturated gelfoam gives superior visualization of the operative area and also tends to stop any oozing that may have resulted from sectioning of the brain.

We have used this method for the past fourteen months without any harmful effects or any increase in the incidence of post-lobotomy seizures.

Method. Three cubic centimeters of pantopaque is absorbed by one gelfoam strip and this strip in turn is squeezed between two dry strips. The amount of pantopaque is sufficient to make all of the strips radiopaque as Figures 1 and 2 show. These strips are inserted into the plane of sectioning after all bleeding has been controlled. Following the insertion, the hole through the cortex is plugged with a small piece of gelfoam and the wound is then closed in the usual manner. The patient is returned to his room via the roentgen-ray department where posteroanterior and lateral films of the skull are taken.

CONCLUSION

A method using pantopaque-soaked gelfoam strips for roentgen visualization of the plane of section following prefrontal lobotomy is described.

270 Commonwealth Ave.
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REFERENCES

1. FREEMAN, A., and WATTS, J. W. Psychosurgery: Intelligence, Emotion and Social Behavior Following Prefrontal Lobotomy for Mental Disorders. Charles C Thomas, Springfield, Illinois, 1942.
2. WHITCOMB, B. B., and SCOVILLE, W. B. Methods of marking plane of section in open lobotomy operation. *Radiology*, 1950, *54*, 741–742.

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THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Thirty-third Annual Meeting: Hotel Claridge, Atlantic City, N. J., June 7–9, 1951.

EDITORIALS

DANGERS OF ABDOMINAL AORTOGRAPHY

SINCE the report of Dos Santos, Lamas and Caldas[1] in 1929 on the use of a radiopaque medium for the visualization of the abdominal aorta and its branches, a considerable literature has emerged advocating the use of this type of study, not only in certain renal diseases, ranging from its use as an estimate of renal function in cases where there is a failure of visualization with an intravenous pyelogram even though the kidney may from clinical observation have an adequate blood supply or where ureteral obstruction prevents the study of the pelvis and calyces of the kidney by a retrograde pyelogram, its use in the differentiation between renal cysts and renal tumors and identification of certain retroperitoneal tumors as being associated or not associated with the kidney, to its use in renal agenesis, etc., as shown by the studies of Shapiro, Peterson, Pirkey and Bell.[2] This method of examination has been of great use also in diseases in which is suspected occlusion of the abdominal aorta. Not only is the roentgenologist able to determine the extent of the occlusion but also the amount of collateral circulation which may be present, and it is particularly helpful in the syndrome of thrombotic obliteration of the aortic bifurcation (the Leriche syndrome),[3] in aneurysms of the abdominal vessels, for visualization of the placenta, particularly in determining the presence of placenta praevia, and it has also been of considerable aid in localization and identification of abdominal tumors by selective study of the circulation.

Dos Santos, Lamas and Caldas in their initial publication reported on 300 cases without a death. However, in 1936, Henline and Moore[4] made an experimental study of this type of examination on dogs and this study showed 5 deaths in the dogs in twenty-one days due to traumatic hemorrhage and 3 deaths due to toxity of substances injected. Dos Santos, in refutation of this work, called attention to the fact that the arterial anatomy and physiology of the dog is not comparable to that of the human and that the observations and deductions made from experimental work on this type of animal is valueless for comparison with the human. The unfavorable experimental study of Henline and Moore delayed the acceptance of the general use of radiopaque medium for visualization of the abdominal aorta for many years and it was not until the work of Fariñas[5] and others[6] that abdominal aortography began to be popularized.

Quite recently at meetings of the American Roentgen Ray Society and the Radiological Society of North America there has been a marked revival of interest in abdominal aortography due to the excellent exhibits and papers at these two society meetings.

It has been pointed out a number of times that while the technique is exacting, it is not necessarily a difficult one when used by those qualified, and, as experience with the procedure is extended with encouraging reports as to its great help in differential diagnoses, the method will become more and more widespread. But while it has great value as a diagnostic procedure, it

[1] Dos Santos, R., Lamas, A. C., and Caldas, J. P. See ref. 3.

[2] Shapiro, D., Peterson, G. M., Pirkey, E. L., and Bell, J. C. Abdominal aortography. Exhibit at Radiological Society of North America, Chicago, Ill., Dec. 10–15, 1950.

[3] Editorial. The Leriche syndrome (thrombotic obliteration of the aortic bifurcation). AM. J. ROENTGENOL. & RAD. THERAPY, Sept., 1950, *64*, 496–498.

[4] Henline, R. B., and Moore, S. W. Renal arteriography. *Am. J. Surg.*, 1936, *32*, 222–229.

[5] Fariñas, P. L. See ref. 3.

[6] Wagner, F. B., Jr., Price, A. H., and Swenson, P. C. See ref. 3.

is not without certain dangers, as all procedures of this type are. In 1950 Dotter and Jackson[7] reported that in an effort to obtain a reliable estimate of the danger of angiocardiography, a questionnaire concerning this type of procedure was sent to many hospitals in the United States, Canada, Great Britain and Sweden. The authors tabulated the returns from this questionnaire and found that death occurred in 26 out of 6,824 investigations, or 0.38 per cent. In North America there was one death in each 397 angiocardiograms, while in Great Britain there was one in 59 angiocardiograms. The difference is apparently due to the fact that in Great Britain the procedure is as yet mainly confined to patients exhibiting congenital heart disease, while in America the examination is also used for other conditions. From an analysis of their collected data it was observed that the commonest cause of death was respiratory arrest immediately or shortly after the injection of the opaque medium. However, in spite of postmortem examinations the immediate cause of death was rarely found. An unexplained finding was that there were very few deaths in the series when the patient was examined in the upright position.

The experimental work of Broman, Forssman and Olsson[8] has possibly thrown some light upon these unexpected catastrophes in the injection of contrast media. Their experimental work was primarily in cerebral angiography, but the injection of such high percentage solutions of contrast media, even at a great distance from the brain, namely, into the abdominal aorta, may be the cause of cerebral damage sufficient to bring about the death of the patient.

Quite recently Wagner and Price[9] reported one death in a series of 50 cases of abdominal arteriography, and they attributed this death to an error in technique. In their patient who died, translumbar abdominal arteriography was performed in an attempt to visualize the renal arteries and their branches. "Ten cubic centimeters of an 80 per cent solution of sodium iodide was injected into the abdominal aorta within five seconds. The anesthetic was administered for three minutes and the arteriographic technique required two minutes. The arteriogram revealed that the needle had been inserted into the orifice of the superior mesenteric artery and that the entire amount of medium was dispersed throughout this vessel and its branches." The death of the patient was ascribed to mesenteric thrombosis.

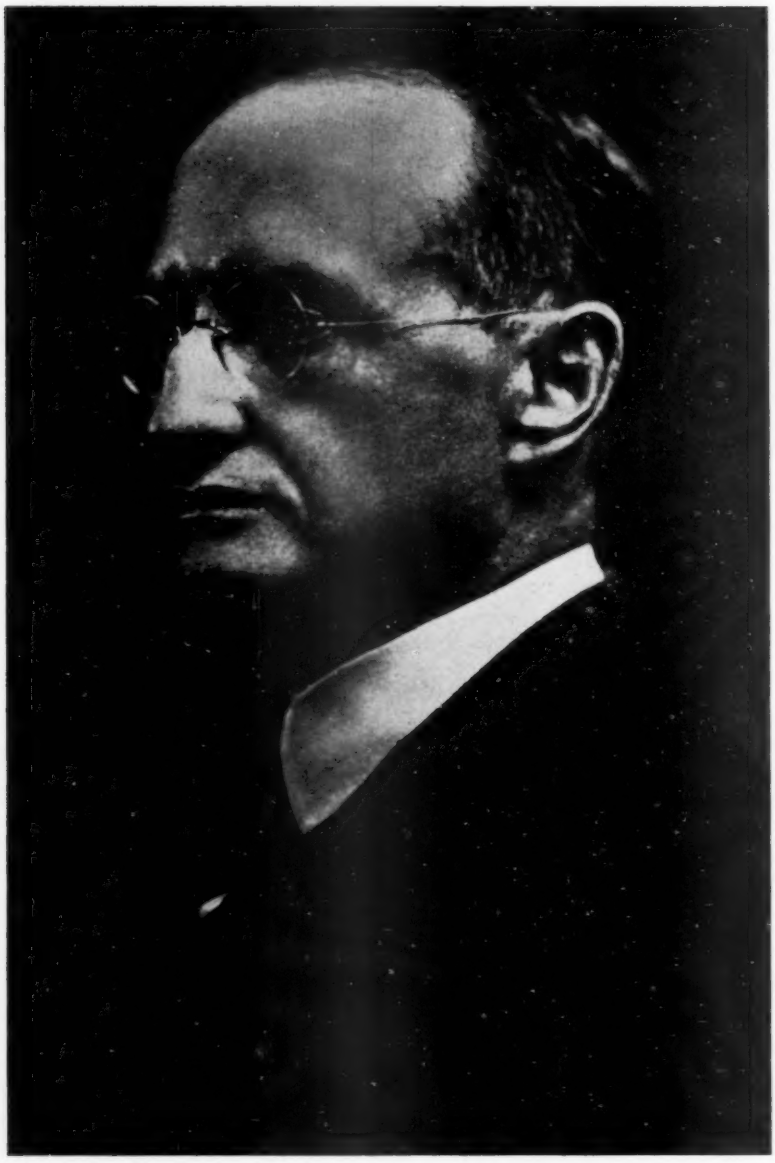
In order to obviate such a danger Wagner and Price recommend that in the performance of abdominal arteriography 10 cc. of a 30 per cent solution of sodium iodide be used initially and that a preliminary roentgenogram be made to determine whether the medium is in the desired site (namely, within the abdominal aorta). If the puncture is satisfactory, then the 80 per cent solution may be injected. From their observations they concluded that the safety of the patient and the success of abdominal arteriography depend upon an exact knowledge of the position of the needle prior to the injection of the medium.

Although abdominal aortography is of great help in arriving at a proper diagnosis in certain diseases, it should be borne in mind that the procedure should not be attempted except by a sufficiently trained personnel and that every precaution should be taken to insure the safety of the patient during such an examination. It should also be borne in mind that, in spite of all precautions this method of examination, while so valuable, is not without certain risks and that every usual type of roentgen examination should be employed before resorting to a diagnostic method of examination which carries a certain hazard and which necessitates the most meticulous technique.

[7] Dotter, C. T., and Jackson, F. S. Death following angiocardiography. *Radiology*, April, 1950, *54*, 527–534.

[8] Broman, T., Forssman, B., and Olsson, O. Further experimental investigations of injuries from contrast media in cerebral angiography; summation of various injurious factors. *Acta radiol.*, July–Aug., 1950, *34*, 135–143.

[9] Wagner, F. B., Jr., and Price, A. H. Fatality after abdominal arteriography; prevention by new modification of technique. *Surgery*, April, 1950, *27*, 621–626.



HENRY J. ULLMANN
1881-1950

WITH a deep sense of loss we record the death of Henry J. Ullmann of Santa Barbara on October 15, 1950. To the American Roentgen Ray Society and the American Radium Society it is the loss of an active and valuable member. To the cancer control program of California it is the loss of a devoted and forceful leader. To his many friends throughout California and the country it is the loss of a warm and very fine friendship.

Dr. Ullmann joined the American Roentgen Ray Society in 1921, and he was a long time member of the American Radium Society of which he was President in 1930–1931. Always an active and interested

member, his presence and discussion were an addition to the annual meetings.

Dr. Ullmann came to the Cottage Hospital in Santa Barbara in 1921. In California he was closely identified with the American Society for the Control of Cancer during its developmental years. His wife, Helen Ingalls Ullmann, was for several years Commander of the Woman's Field Army. Both were efficient and valuable leaders in the work of the Society. When the Cancer Commission of the California Medical Association was established in 1931, Dr. Ullmann was one of the original members, and he played an active and important part up to the time of his death. Dr. Ullmann has been a member of the Board of Directors of the California Division of the American Cancer Society since its incorporation. His leadership and interest in the cancer control program in California and in Santa Barbara led to the formation of the Memorial Research Foundation in the Cottage Hospital, with its large radiation therapy wing and million volt apparatus.

Before entering medicine, Dr. Ullmann was a trained engineer. With his interest in preparation in fundamental physics as well as in clinical medicine, he has been an outstanding leader in radiation therapy in his state for the past twenty-five years. Primarily an efficient and kindly clinician, he was also able to conduct an important research program during that time. In the early years, Dr. Ullmann's engineering training was helpful in his office. He has always had a well equipped machine shop where he has taken great pride in making the various filters, instruments and other gadgets needed in his work in roentgen rays and radium.

Many of Dr. Ullmann's friends in radiology and cancer control throughout the country have shared the gracious hospitality of his home on Hill 70. They will miss him both as a scientific physician and as a friend. Their deepest sympathy goes to those who survive him, his wife, Helen Ingalls Ullmann and his daughter, Helen Ullmann Leatherbee.

Lyell C. Kinney, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Shoreham Hotel, Washington, D.C., Sept. 25–28, 1951.

AMERICAN RADIUM SOCIETY
Secretary, Dr. J. E. Wirth, U. S. Marine Hospital, Baltimore, Md. Annual meeting: Hotel Claridge, Atlantic City, N. J., June 7–9, 1951.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y., Annual meeting: 1951, to be announced.

AMERICAN COLLEGE OF RADIOLOGY
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. P. C. Hodges, 950 E. 59th St., Chicago, Ill.

ALABAMA RADIOLOGICAL SOCIETY
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS
Secretary, Dr. R. Lee Foster, 507 Professional Bldg., Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

ARKANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

ATLANTA RADIOLOGICAL SOCIETY
Secretary, Dr. T. F. Leigh, Emory Univ. Hospital, Emory University, Ga. Meets monthly, except during three summer months, on second Friday evening.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

CENTRAL OHIO RADIOLOGICAL SOCIETY
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

CINCINNATI RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio. Meets last Monday of each month, September to May, inclusive.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Hannan, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

COLORADO RADIOLOGICAL SOCIETY
Secretary, Dr. Paul E. RePass, 306 Republic Bldg., Denver 2, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

CONNECTICUT VALLEY RADIOLOGIC SOCIETY
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

DALLAS-FORT WORTH ROENTGEN STUDY CLUB
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. J. C. Cook, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

EAST BAY ROENTGEN SOCIETY
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

FLORIDA RADIOLOGICAL SOCIETY
Secretary, Dr. T. H. Lipscomb, 30 W. Beaver St., Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

GEORGIA RADIOLOGICAL SOCIETY
Secretary, Dr. R. C. Pendergrass, Americus, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

GREATER MIAMI RADIOLOGICAL SOCIETY
Secretary, Dr. David Kirsh, 712 duPont Bldg., Miami 32, Florida. Meets last Wednesday of each month at 8:00 P.M. at Veterans Administration Regional Office.

HOUSTON X-RAY CLUB
Secretary, Dr. Curtis H. Burge, 3020 San Jacinto St., Houston 4, Texas. Meets fourth Monday each month.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

IOWA X-RAY CLUB
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society.

KANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

KENTUCKY RADIOLOGICAL SOCIETY
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

KINGS COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

LOS ANGELES RADIOLOGICAL SOCIETY
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

LOUISIANA RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

* Secretaries of societies are requested to send timely information promptly to the Editor.

Maine Radiological Society
Secretary, Dr. C. F. Miller, Central Maine General Hospital, Lewiston, Maine.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

Michigan Association of Roentgenologists
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

Mid-Hudson Radiological Society
Secretary, Dr. J. W. Walton, Horton Memorial Hospital, Middletown, N. Y. Meets 8:30 P.M., fourth Tuesday each month, Sept. to May.

Milwaukee Roentgen Ray Society
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

Nebraska Radiological Society
Secretary, Dr. R. W. Blanchard, 1216 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. L. L. Robbins, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Harvard Club.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. J. L. Olpp, 49 Ivy Lane, Tenafly, N. J. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

Northern California Radiological Club
Secretary, Dr. C. W. Wauters, 701 High St., Auburn, Calif. Meets at dinner last Monday, every second month, except June, July and August.

Ohio State Radiological Society
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. W. E. Brown, 21st & Xanthus, Tulsa 4, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. C. T. Jessell, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport.

Philadelphia Roentgen Ray Society
Secretary, Dr. G. P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Queens Roentgen Ray Society
Secretary, Dr. J. E. Goldstein, 88-29 163rd St., Jamaica 3, N. Y. Meets fourth Monday of each month except during the summer.

Radiological Section, Baltimore Medical Society
Secretary, Dr. Harry A. Miller, 2452 Eutaw Place, Baltimore. Meets third Tuesday each month, Sept. to May.

Radiological Section, Connecticut Medical Society
Secretary, Dr. Fred Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

Radiological Section, District of Columbia Medical Society
Secretary, Dr. K. C. Corley, 1835 Eye St., N. W., Washington, D. C. Meets Medical Society Auditorium, third Thursday, Jan., March, May, Oct. at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr. Roy G. Giles, Temple, Texas.

Radiological Society of New Jersey
Secretary, Dr. Peter Gianquinto, 685 High St., Newark, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. A. V. Winchell, 40 Meigs St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

St. Louis Society of Radiologists
Secretary, Dr. H. R. Senturia, Pasteur Medical Building, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

San Diego Roentgen Society
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Tuesday at dinner.

Section on Radiology, California Medical Association
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Carolina X-Ray Society
Secretary, Dr. S. H. Fisher, 107 E. North St., Greenville, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Meets Galveston, Jan 19 and 20, 1951.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

VIRGINIA RADIOLOGICAL SOCIETY
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

WASHINGTON STATE RADIOLOGICAL SOCIETY
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

WISCONSIN RADIOLOGICAL SOCIETY
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-RAY STUDY CLUB OF SAN FRANCISCO
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets Jan. to July, Lane Hall, Stanford Univ. Hospital; July to Dec. San Francisco Hospital.

CUBA, MEXICO AND CENTRAL AMERICA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

SOCIEDAD MEXICANA DE RADIOLOGIA Y FISIOTERAPIA
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

SOCIEDAD RADIOLÓGICA PANAMEÑA
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86 Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

FACULTY OF RADIOLOGISTS
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

SECTION OF RADIOLOGY OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

CANADIAN ASSOCIATION OF RADIOLOGISTS
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

SECTION OF RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

AUSTRALIAN AND NEW ZEALAND ASSOCIATION OF RADIOLOGISTS
Honorary Secretary, Dr. Alan R.Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

SOUTH AMERICA

ASOCIACION ARGENTINA DE RADIOLOGIA
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, JUNTA CENTRAL, BUENOS AIRES
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL LITORAL, SEDE, ROSARIO
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL SUR, SEDE, LA PLATA
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL CENTRO, SEDE, CORDOBA
President, Prof. Dr. David L. Caro, Cerro 86, Cordoba. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL NORTE, SEDE, TUCUMAN
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DE CUYO, SEDE, MENDOZA.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

SOCIEDADE BRASILEIRA DE RADIOLOGIA MEDICA
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

SOCIEDADE BRASILEIRA DE RADIOTERAPIA
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

SOCIEDAD COLOMBIANA DE RADIOLOGIA
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.

SOCIEDAD PERUANA DE RADIOLOGIA
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

SOCIEDAD DE RADIOLOGICA, CANCEROLOGIA Y FISICA MEDICA DEL URUGUAY
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

CONTINENTAL EUROPE

SOCIÉTÉ BELGE DE RADIOLOGIE
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

CESKOSLOVENSKÁ SPOLEČNOST PRO RÖNTGENOLOGII A RADIOLOGII V PRAZE
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

GDANSK SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad. USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Societa Italiana di Radiologia Medica
Secretary Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually

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GRADUATE FELLOWSHIPS IN RADIOLOGICAL PHYSICS

The Atomic Energy Commission announces a program for Graduate Fellowships in Radiological Physics for 1951–1952. It is the purpose of this fellowship program to give training in radiological physics to selected college graduates with degrees in basic science or engineering. This program is accredited for graduate-level training leading toward an advanced degree.

The primary requisite in the selection of these Fellows is an undergraduate degree where the major subject has been physics, chemistry or engineering (usually electrical or chemical) with minor in mathematics, biophysics or similar fields. Applicants with other qualifications may be considered in special circumstances.

A Fellow must be a citizen of the United States under thirty-five years of age. Evidence of citizenship must be available and security regulations must be satisfied.

Two training programs will be conducted: one at the University of Rochester, Rochester, New York, in cooperation with Brookhaven National Laboratory at Upton, Long Island, New York; the other, at Vanderbilt University, Nashville, Tennessee, and Oak Ridge National Laboratory, Oak Ridge, Tennessee. Applicants may indicate their choice of training center and, whenever possible, assignment will be made to the requested center.

Requests for application blanks or for additional information should be made to the Office of the Head of the Physics or Engineering Department of the applicant's school, or by writing to: Oak Ridge Institute of Nuclear Studies, University Relations Division, P. O. Box 117, Oak Ridge, Tennessee.

Applications, etc., must be completed by March 1, 1951.

RADIOLOGICAL SOCIETY OF NEW JERSEY

The Radiological Society of New Jersey will hold its mid-winter meeting at the Winfield-Scott Hotel in Elizabeth, New Jersey, on February 3, 1951, beginning at 2:30 P.M.

The program is as follows:

2:30 P.M. Hospital-Radiologist relationships. Frederic E. Elliott, M.D., Vice-President and Director of Medical Services, United Medical Services, Inc., New York.

5–7 P.M. Dinner.

7:00 P.M. Tumors of the Chest. Herbert C. Maier, M.D. Attending Surgeon, Lenox Hill Hospital; Assistant Clinical Professor of Thoracic Surgery, New York University, Post Graduate Division, New York.

SAN DIEGO RADIOLOGICAL SOCIETY

As the regular monthly meeting of the San Diego Radiological Society on December 5, 1950, the following officers were elected for the coming year: *President:* Dr. Ely Whitehead; *Vice-President*, Dr. John Eneboe; *Secretary-Treasurer*, Dr. R. F. Niehaus. The monthly meeting date has been changed from the first Wednesday to the first Tuesday of each month at dinner.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

Urologic Roentgenology. By Miley B. Wesson, M.D., Past President American Urological Association. Third edition, thoroughly revised. Cloth. Price, $7.50. Pp. 282, with 284 illustrations. Lea & Febiger, Washington Square, Philadelphia 6, Pennsylvania, 1950.

The third edition of Wesson's well known book has maintained the excellent standards of the previous publications, while at the same time sixty new illustrations and twenty-three pages of text have been added. This book offers an unusually effective means of teaching roentgen interpretation of urologic disease. It should be of particular value to the clinician interested in urology, to the general practitioner, the physician studying urology and to the student of radiology. The text is well written. While it is necessarily condensed, this does not detract from the value of the book because the author has not omitted any important parts of the roentgenological interpretation of urinary tract disease. In general, the book avoids any prolonged discussion of controversial issues.

From the viewpoint of the teacher of urological roentgenology, there are a few statements in the book which might be considered as controversial. The chapter on roentgenographic equipment might be revised in part, as it seems to miss the guiding hand of the experienced radiologist. One other criticism which comes to the mind of the reviewer is the lack of any references to pediatric urological problems. From the standpoint of technical procedure and pathologic process, children frequently present problems peculiar to their age. Therefore, it might be advisable to consider including a chapter on such disease when future editions are published.

The two hundred and eighty-four excellent illustrations have been selected with care. They present both the rare and the more common roentgen appearances of diseases of the urinary tract. Each illustration is accompanied by a short case history or explanatory legend.

The quality of the printing and the excellent paper used in this book add to its value.

George W. Chamberlin, M.D.

Étude Téléradiographique des Poumons, du Coeur et de l'Estomac de Nourrissons Normaux. By A. Jaubert de Beaujeu and Marcel Caruana. Paper. Price, 3,500 francs. Pp. 238, with 127 illustrations. Libraire Maloine, 27, Rue de l'École-de-Médecine, Paris 6e, France, 1950.

The 127 teleroentgenograms which are presented in this work of 238 pages, all made in the vertical position, include the thorax, lungs, the thoracic cardiovascular system, the stomach, the small intestine, and occasionally the large intestine of normal nursing infants between the first days after birth and the eighteenth month. The reproductions are life size, so that all the details should appear clearly, and thus make the book a valuable reference work. The 127 teleroentgenograms were made on 45 nurslings. An introductory chapter deals with the roentgenographic technique and the methods of interpretation. The final chapter gives the results of the observations which the authors admit contribute little new material, but they have served to confirm certain classic findings dealing with organs about which there has been some question.

The children were all examined after fasting from midnight on. After quick roentgenoscopy and fifteen minuutes after the introduction of 30 to 60 grams of sterilized opaque medium (syrup of sugar and sulphate of barium) the child is placed on a special support, holding the face vertically against the cassette, the tube distance being 2.50 meters. The authors used a four-valve generator and a Coolidge deep therapy tube for 200 kv., tension 200 kv., intensity 150 to 200 ma., 1/20 second. With these constants, the thoracic and abdominal organs were all obtained at the same time on a 10 by 12 inch film. Twenty minutes later the child was studied in the same position at 2.50 meters. The films were only very slightly enlarged, corresponding to those of the orthogonal projection. This method is of great importance for the measurement of the diameter of the heart. The illustrations are beautifully reproduced. The final chapter recapitulating all the findings is

very interesting. Pediatricians and others interested in the roentgen study of children will find this work of great value. The press work is excellent.

James T. Case, M.D.

Carcinoma of the Tongue. A Clinical Study of 277 Cases Treated at Radiumhemmet, 1931–1942. *Acta radiologica*, Supplementum lxviii. By Folke Jacobsson. Paper. Price, Swedish Crowns 20.–. Pp. 184, with 24 illustrations and 18 tables. Esselte Aktiebolag, Stockholm, Sweden, 1948.

This elaborate article is built around a careful tabulation of the available information obtained from a study of 277 patients with cancer of the tongue. Facts tabulated include predisposing factors, sketches showing the location of each lesion, treatment factors and subsequent history.

The author emphasizes the high incidence of cancer of the tongue noted in women with Plummer-Vinson's syndrome and prefers to call the condition sideropenia because of the low serum iron value which is a characteristic sign.

Although many methods of treatment were tried, preference was given to a combination of teleradium therapy and electrocoagulation. This plan seems to indicate a lack of confidence in teleradium alone. Such an attitude may be explained by the fact that the tumor dose adopted lay in the neighborhood of 5,500 gamma roentgens given in a period of fourteen days. Although some cures were obtained with this technique alone, the reviewer considers it to be rather low. Implanted radium needles were used with coagulation for a time and then abandoned. Since only high intensity needles were used for short periods of time and since tumor doses ranged from 2,250 r to 2,600 r good results could hardly be expected. Metastatic cervical lymph nodes were treated by teleradium followed by a neck dissection when palpable remnants could be detected. The neck was usually treated with teleradium when no nodes were palpable but prophylactic neck dissections were not done.

A relative five year cure rate of 28.1 ± 2.8 per cent was obtained in a series of 267 verified cases. In 103 cases without clinical metastases on admission or later, the five year cure rate was 52 per cent, and in 66 cases with the primary tumor confined to the tongue with a maximum diameter of 3 cm. and without metastases, the five year cure rate was 65 per cent. A cure rate of 28 per cent was reported for a series of 24 cases with microscopically verified metastases treated by teleradium and block dissection. However, only 15 per cent of 130 cases with clinical metastases in the lymph nodes survived five years and the salvage in a group that developed metastases after admission was only 6 per cent.

Charles L. Martin, M.D.

Surgical Treatment for Abnormalities of the Heart and Great Vessels. The Beaumont Lecture, Wayne County Medical Society, Detroit, Michigan. Second printing. By Robert E. Gross, M.D., William E. Ladd Professor of Child Surgery, Harvard University Medical School, Boston, Massachusetts. Fabrikoid. Price, $2.00. Pp. 72, with 36 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

This small monograph contains material presented before the Wayne County (Mich.) Medical Society as the 25th Beaumont Lecture and was first published in 1947. The author has presented in simple form the treatment of those congenital abnormalities of the heart and great vessels which are amenable to surgical correction. The illustrations are excellent and the format pleasing.

Abnormalities such as patent ductus arteriosus to which the author has made so many fundamental contributions are treated more fully than the tetralogy of Fallot, for example, which occupies but a few pages. In this volume no attempt could be made to present each subject exhaustively.

Such rapid progress has been made in vascular surgery during the past few years that many contributions of great importance in the field are not included. It is to be regretted that these were not added to the volume. As an introduction to the field of surgery of the heart and great vessels, this monograph is a valuable addition to any library. Those interested in more detailed accounts of diagnosis or specific surgical technique must consult the original articles.

Herbert E. Sloan, M.D.

A Short Textbook of Radiotherapy. For Technicians and Students. With a Supple-

mentary Chapter for the Dermatologist. By J. Walter, M.A., B.M. (Oxfd.), M.R.C.P. (Lond.), D.M.R.E. (Camb.), Consultant Radiotherapist and Deputy Medical Director, Sheffield National Centre for Radiotherapy; and H. Miller M.A., PH.D., (Camb.), F. Inst. P., Physicist, Sheffield National Centre for Radiotherapy. Foreword by J. L. A. Grout, M.C., F.R.C.S. (Ed.), F.F.R., D.M.R.E., Vice-President, Faculty of Radiologists; Past-President, Section of Radiology, Royal Society of Medicine. Cloth. Price, $6.00. Pp. 444, with 199 illustrations. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, Pennsylvania, 1950.

This book is based on a series of lectures presented to student radiographers preparing for the qualifying examination for M.S.R. (Member of the Society of Radiographers), or C.T. (Certificate of Therapy). Due to diverse educational backgrounds in preliminary scientific subjects, these candidates are assumed to possess only an elementary knowledge of electricity and magnetism, elementary biology, and physiology. The authors have most successfully attempted the simplification of a difficult subject. This book is not designed for the post-graduate radiologist, but the sections on physics may serve as an introduction or review to him. The house surgeon and others in the profession outside the radiological fold will find this text an excellent aid in orienting them in matters of radiation therapy.

The first portion of the volume is devoted to the structure of matter, the physical properties of roentgen rays and their generation, and the physical aspects of roentgen therapy. Natural and artificial radioactive materials are described and, in an appendix to the book, their use as tracers and therapeutic agents is described. Newer problems in protection from and the disposal of radioactive isotopes have arisen since the advent of their use. The biologic aspects of radiation therapy are understandably explained.

Various methods and techniques using both roentgen rays and radium for the treatment of neoplastic disease are presented to give the student an appreciation of these modalities and their methods of use. Benign as well as malignant diseases are categorized and illustrative diseases are described. In general, the techniques are well known and have received wide usage in both England and the United States.

Essential facts pertaining to radiation protection are fully described and one of the appendices is taken from the Recommendations of the British X-ray and Radium Protection Committee, listing specifications for radiation protection. The duties and responsibilities of the radiotherapeutic technician are presented in a timely manner and should be read by all engaged in such work. The management of patients presenting themselves for radiotherapy is not a matter to be left to chance.

The authors feel that a paucity of radiological literature exists for the dermatologist. A supplementary chapter designed to aid the dermatologist contains a review of the subject material pertaining to physics, and describes diseases peculiar to this specialty, with notes regarding methods of treatment.

The text is adequately supplemented by numerous photographic and diagrammatic illustrations. Tables of physical data further amplify the discussions. The book is well organized and the index is complete and accurate. Numerous footnotes supply the Latin and Greek roots for each new medical term as it is introduced.

This book is of inestimable value to the student radiographer, grounding him in the elementary physics of radiology and giving him a working knowledge of clinical radiotherapeutic practices. A mastery of this text would increase his worth as well as understanding. It is written in a readily understandable manner, a task not easy when dealing with an intricate subject, abstract to many. The authors are to be commended for making this text available to teachers for use as a course book and to students for use as a textbook and constant companion. It is highly recommended to interns, nurses, and others seeking a bird's-eye view of radiological physics and therapy.

K. L. KRABBENHOFT, M.D.

ALLGEMEINE STRAHLENTHERAPIE—LICHT, RÖNTGENSTRAHLEN, RADIUM. By Prof. Dr. Otto Jüngling. Edited by Doz. Dr. R. Glauner und Prof. Dr. H. Langendorff. Second edition. Cardboard. Price, Dm 29.50 bound. Pp. 354, with 145 illustrations. Ferdinand Enke, Publisher, Hosenhergesteige 3, Stuttgart, Germany, 1949.

Jüngling, the author of the first edition of this fundamental text published in 1938, died in 1944, and therefore Glauner and Langen-

dorff undertook the preparation of the second edition. They were guided in their task by the many notes which Jüngling had left and to which—through the cooperation of Mrs. Hildegard Jüngling—they had free access. In deference to the late author, the revising team kept the original character of the book intact and added new knowledge wherever available.

The subject matter has been arranged under 3 main headings: I. Physical foundations; II. Light; III. Roentgen rays (cathode rays and radium). Of these the last occupies the largest portion (over 200 pages) of the text. In Section I the physical principles of radiant energy are briefly discussed. Section II is devoted to the physics of light, the biologic effects of natural and artificial sources of light and their application in tuberculosis and other pathological processes. In the last and major part, the authors cover the following topics: physical and technical aspects; the biologic effects of roentgen rays and gamma rays of radium; the effects of roentgen rays and radium on tumor cells; radiation therapy vs. surgery; medical statistics; pre- and postoperative irradiation; the curative and palliative use of radiation therapy, the effect of irradiation on sarcomas and other tumors; radiation therapy of inflammatory diseases and of blood dyscrasias; the use of irradiation in diseases of the central nervous system. A short supplement deals with the therapeutic use of radioactive substances in the form of baths, oral administration, inhalation, packs and injections; the latter method of administration is not recommended.

This book may well be termed "Fundamental principles of radiation therapy," and certainly offers a wealth of information to the radiologist, especially to the beginner. A slight drawback lies in the unavoidable absence of references to the recent foreign literature, another after-effect of World War II. The illustrations are well chosen and are instructive. Some are not as well reproduced as others, undoubtedly due to a limited supply of high grade printing stock. If Jüngling could see this revised second edition I am sure he would be pleased with the results of Glauner's and Langendorff's efforts.

Ernst A. Pohle, M.D.

BOOKS RECEIVED

Die klinische Röntgendiagnostik der inneren Erkrankungen. Von Prof. Dr. Herbert Assmann. Sechste Auflage. Erster Teil. Cloth. Price DM 59.60. Pp. 419, with 501 illustrations and 10 tables. Lange & Springer, Wissenschaftliche Buchhandlung, Berlin W 35, Germany, 1950.

Die klinische Röntgendiagnostik der inneren Erkrankungen. Von Prof. Dr. Herbert Assmann. Sechste Auflage. Zweiter Teil. Cloth. Price DM 75.60. Pp. 604, with 859 illustrations. Lange & Springer, Wissenschaftliche Buchhandlung, Berlin W 35, Germany, 1950.

Diagnosis and Treatment of Tumors of the Head and Neck. (Not Including the Central Nervous System.) By Grant E. Ward, M.D., D.Sc., F.A.C.S., and James W. Hendrick, M.D., M.S., from the Departments of Surgery of the School of Medicine, University of Maryland, and the Johns Hopkins University School of Medicine, and the Oncology Clinic of the University Hospital and the Tumor Clinic of the Johns Hopkins Hospital. Cloth. Price, $15.00. Pp. 832, with 637 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Avenues, Baltimore, Maryland, 1950.

Étude Téléradiographique des Poumons, du Coeur et de l'Estomac de Nourrissons Normaux. Par A. Jaubert de Beaujeu et Marcel Caruana. Paper. Price, 3,500 francs. Pp. 238, with 127 illustrations. Libraire Maloine, 27, Rue de l'École-de-Médecine, Paris 6e, France, 1950.

Las Formas Anatomoclínicas de la Tuberculosis Traqueobronquial en Sus Relaciones con la Tuberculosis Pulmonar del Niño y del Adulto. Por el doctor Manuel Tapia. Ex Director del Hospital del Rey, para enfermedades infecciosas y tuberculosis, de Madrid, Ex Profesor de la Escuela Nacional de Sanidad, Ex Profesor del Instituto Nacional de Higiene de Alfonso XIII, Ex Director del Sanatorio de la Fuenfría, Director científico de la Estancia Sanatorial del Caramulo (Portugal) con la colaboración de los doctores José Manuel Soares de Oliveira y Luis Cerezo, Médicos asistentes de la Estancia Sanatorial del Caramulo. Con un capítulo sobre la técnica de la broncoscopia por el doctor Antonio da Costa Quinta, Otorrinolaringólogo del Hospital Infantil de San Roque, de Lisboa, Broncoscopista de la Estancia Sanatorial del Caramulo. Cloth. Price, 390 ptas. Pp. 718, with 516 illustrations. Editorial Alhambra, Mayor, 4, Madrid, Spain, 1950.

Coxitis Tuberkulosa. Ein Beitrag zur röntgenologischen Pathologie der Skelettuberkulose. Sonderbände zur Strahlentherapie, Band 26. Von Dozent Dr. Herbert Gardemin. Chefarzt der Orthopädischen Abteilung des Evangelischen Waldkrankenhauses, Berlin-Spandau. Paper. Price, geh. 15.–, geb. DM 18.–. Pp. 166, with 245 illustrations. Urban & Schwarzenberg, Berlin-Charlottenberg, Branitzer Platz 5, Germany, 1950.

Bone and Joint Diseases. Pathology Correlated with Roentgenological and Clinical Features. By J. Vernon Luck, M.S. (Ortho.), M.D., F.A.C.S., F.I.C.S., Assistant Clinical Professor of Orthopedic Surgery, University of Southern California, Senior Attending Physician, Department of Orthopedic Surgery, and Consultant in Orthopedic Pathology, Los Angeles County Hospital, Member, Subcommittee in Orthopedic Surgery, National Research Council, Member, Board of Associate Editors, Journal of Bone and Joint Surgery. Cloth. Price $16.50. Pp. 614, with 703 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

Betekenis en Bepaling van de Skeletleeftijd. With a Summary and an Atlas in English. Avec un résumé et un atlas en français. Door Bernard Speijer, Geboren te 's Gravenhage. Paper. Pp. 153, with 210 illustrations. Eduardo Ijdo N. V., Leiden, Netherlands, 1950.

Technika Rentgenowska. Napisł Mgr Inz. Jósef Domanus przy współudziale Mgra Inz. Jerzego Rudzinskiego i Inz. Jerzego Dobrskiego. Paper. Pp. 158, with numerous tables and illustrations. Trzaska, Evert i Michalski, Warszawa, Marszałkowska 51, Poland, 1948.

Determination of Physical Factors Influencing the Quality of the Radiographic Image. (The Reproduction Number Method and Its Application.) Acta radiologica, Supplementum LXXVI. By Arne Nelson. Paper. Price. Swed. Crowns 15:–. Pp. 87, with 24 illustrations. Esselte Aktiebolag, Stockholm, Sweden, 1949.

Supervoltage Roentgentherapy. By Franz Buschke, M.S., Simeon T. Cantril, M.D., and Herbert M. Parker, M.Sc. From the Tumor Institute of the Swedish Hospital, Seattle, Washington. Cloth. Price, $10.50. Pp. 375, with 260 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

A Short Textbook of Radiotherapy. For Technicians and Students. With a Supplementary Chapter for the Dermatologist. By J. Walter, M.A., B.M. (Oxfd.), M.R.C.P. (Lond.) D.M.R.E. (Camb.), Consultant Radiotherapist and Deputy Medical Director, Sheffield National Centre for Radiotherapy; and H. Miller, M.A., Ph.D. (Camb.), F.Inst.P., Physicist, Sheffield National Centre for Radiotherapy. Foreword by J. L. A. Grout, M.C., F.R.C.S. (Ed.), F.F.R., D.M.R.E., Vice-President, Faculty of Radiologists; Past-President, Section of Radiology, Royal Society of Medicine. Cloth. Price, $6.00. Pp. 444, with 199 illustrations. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, Pennsylvania, 1950.

Medical Physics. Volume II. Otto Glasser, Ph.D., F.A.C.R., Editor-in-Chief, Diplomate in Radiological Physics, American Board of Radiology; Professor of Biophysics, Frank E. Bunts Educational Institute; Head, Department of Biophysics, Cleveland Clinic Foundation; Consultant, U. S. Veterans Administration, Washington, D. C. Cloth. Price, $25.00. Pp. 1,227, with 978 illustrations. Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, Illinois, 1950.

Enzymes, Growth, and Cancer. By Van R. Potter, Ph.D., Professor of Oncology, University of Wisconsin Medical School, Madison, Wisconsin. Fabrikoid. Price. $1.85. Pp. 64. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

Der Ultraschall in der Medizin. Kongressbericht der Erlanger Ultraschall-Tagung 1949. Herausgegeben im Auftrage der Ultraschall-Arbeitsgemeinschaft von den Veranstaltern der Tagung: Prof. Dr. K. Matthes, Direktor der Medizinischen Universitätsklinik, Erlangen; und Prof. Dr. W. Rech, komm. Leiter der Universitätsfrauenklinik, Erlangen. Für den Druck überarbeitet von Dr. F. Wachsmann. Paper. Price, Fr. 30.–. Pp. 475, with numerous illustrations. S. Hirzel, Claridenhof, Gotthardstrasse 6, Zürich, 2, Switzerland, 1949.

Praktische Elektrokardiographie. Extremitäten-EKG, Brustwand-EKG, Belastungs-EKG. Von Franz Kienle, Dr. med. habil., Dr. phil., Dozent für Innere Medizin, Chefarzt der II. Med. Klinik der Städtischen Krankenanstalten Karlsruhe. Dritte Auflage. Cloth. Price, DM 38.–. Pp. 448, with 426 illustrations. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart O, Germany, 1950.

Annual Report of the Federal Security Agency 1949. Public Health Service. Paper. Price, 40 cents. Pp. 173, with several charts and tables. United States Government Printing Office, Washington 25, D. C., 1950.

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ABSTRACTS OF RADIOLOGICAL LITERATURE

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INDEX TO ABSTRACTS

ROENTGEN DIAGNOSIS

Abdomen

Ripstein, C. B., and Miller, G. G.: Volvulus of the small intestine . . . 296
Keeley, J. L.: Intussusception associated with aberrant pancreatic tissue . . . 296
Terjung, H.: On appendix stones . . . 296
Berlin, L., and Cotton, R.: Gastro-intestinal manifestations of porphyria . . . 296
Rice-Oxley, J. M., and Truelove, S.: Complications of ulcerative colitis . . . 297
Bartley, C. W.: Steatorrhoea in a family . . . 297
Moreton, R. D., and Yates, C. W.: Double-contrast study of the colon . . . 297
Jutras, A., and Gernez, A.: Visibility of the biliary ducts in the course of roentgenologic examination of the digestive tract . . . 297

Gynecology and Obstetrics

Hildreth, R. C., and Chrest, C. P.: Uterogram in sterility . . . 298
Maršálek, J.: Hysterosalpingography with subsequent hydropertubation . . . 298
Reicher, N. B., Massey, B. W., and Bechtold, E.: Clinical evaluation of 3500 vaginal cytologic studies . . . 298
Gold, E. M.: "Pelvic drive" in obstetrics . . . 299
Corner, G. W., Jr., Hu, C.-Y., and Hertig, A. T.: Ovarian carcinoma arising in endometriosis . . . 299
Delascio, D., and Guariento, A.: Neoplasms of the ovary and pregnancy . . . 299

Genitourinary System

Harrison, F. G., Warres, H. L., and Fust, J. A.: Neuroblastoma involving the urinary tract . . . 300
Sporer, A., and Greenberger, M. E.: Experimental studies on the pathogenesis and prognosis of renal tuberculosis . . . 300
Lattimer, J. K., Amberson, J. B., and Braham, S.: Streptomycin treatment of genitourinary tuberculosis . . . 301
Alken, C. E.: Dyskinesis of the kidney pelvis and ureter . . . 301
Günther, G. W.: Morphology and symptomatology of the renal tumors . . . 301
Hawkins, C. F., and Smith, O. E.: Renal dysplasia in a family with multiple hereditary abnormalities including iliac horns . . . 302
Weyrauch, H. M., and Fleming, A. E.: Congenital hydrocalycosis . . . 302
Simril, W. A., and Rose, D. K.: Replacement lipomatosis and its simulation of renal tumors . . . 302
Günther, G. W.: Nephrectomy in "essential" hematuria due to the misinterpretation of pyelograms . . . 302
Edling, N. P. G.: Demonstration of the urethra and the bladder by means of water soluble contrast medium . . . 303
Dean, A. L., and Ash, J. E.: Study of the bladder tumors in the Registry of the American Urological Association . . . 303

Nervous System

Camp, J. D.: Contrast myelography past and present . . . 303

Skeletal System

Roth, H.: On the problem of the "bone bank" 304
Lemahieu, S. F.: Gargoylism . . . 304
Clara, R., and Thys, L.: Lipochondrodystrophy (gargoylism, Hurler's disease, Pfaundler-Hurler's disease, etc.) . . . 305
von Nida, S.: Differential diagnosis of the so-called cortical osteoid . . . 306
Genscher, W.: Primary acute purulent osteomyelitis of the spine . . . 307
Oelbaum, M. H.: Medical aspects of carcinoma of the prostate with secondary deposits in bone . . . 307
Cocchi, U.: Genetic chart in marble bone disease with dominant polyphan heredity . . . 307
Böhler, J.: Pneumoroentgenography of the knee joint . . . 308
Somerville-Large, C.: Strains of the ankle joint . . . 308
Mennenga, M.: Genesis of local bone necroses 308
Greenfield, M. M., and Wallace, K. M.: Pigmented villonodular synovitis . . . 309
Haas, S. L.: Restriction of bone growth by pins through the epiphyseal cartilaginous plate . . . 309
Hess, W. E., and Street, D. M.: Melorheostosis . . . 310
Steel, H. H.: Calcified islands in medullary bone . . . 310

Townley, C. O.: Capsular mechanism in recurrent dislocation of the shoulder..... 310
Adams, J. C.: Humeral head defect in recurrent anterior dislocation of the shoulder..... 311
Seidenstein, H.: Acute pain in the wrist and hand associated with calcific deposits..... 311
Peterson, L. T.: Dislocation of the hip associated with fracture of the neck of the femur..... 312
Pipkin, G.: Lesions of the suprapatellar plica.. 312
Erickson, P. T., and Mayoral, A.: Unusual lesion of the talus occurring in leprosy.... 312
Hark, F. W.: Rocker-foot due to congenital subluxation of the talus..... 312
Herschel, H., and von Ronnen, J. R.: Occurrence of calcaneonavicular synosteosis in pes valgus contractus..... 313
Baker, S. L., *et al.*: Metastatic tumours of bone..... 313
Prevo, S. B.: Clinical analysis of 205 cases of malignant bone tumor..... 315
Stewart, M. J., and Otis, E. J., Jr.: Giant-cell tumor confined to the greater trochanter..... 315
D'Alo, R.: Plasmocytomas..... 315
Coley, B. L., and Harrold, C. C., Jr.: Analysis of fifty-nine cases of osteogenic sarcoma with survival for five years or more..... 316
Middlemiss, J. H.: Tomography and its application to investigations of the spine..... 316
Ford, L. T., and Key, J. A.: Evaluation of myelography in the diagnosis of intervertebral-disc lesions in the low back..... 317
Bücker, J.: Air myelography in herniation of the intervertebral disc..... 318
Albrecht, K., and Dressler, W.: Contrast delineation of the peridural space (Peridurography)..... 318
Toumey, J. W., Poppen, J. L., and Hurley, M. T.: Cauda equina tumors as a cause of the low-back syndrome..... 318
McCarty, R. B.: Presacral tumors..... 319
Roche, M. B.: Healing of bilateral fracture of the pars interarticularis of a lumbar neural arch..... 319

Blood and Lymph System

Felder, D. A.: Method of venography..... 319
Felder, D. A.: Anatomical-spatial relationships of the deep veins of the lower extremity as a basis for venographic interpretation..... 319
Frimann-Dahl, J.: Roentgen examination in acute thrombosis..... 320
Prat, D., and Guelfi, A. G.: Venous phlebitis and thrombosis..... 320

General

Caffey, J.: Chronic poisoning due to excess of Vitamin A..... 320
Akwa, C. M., Kanter, J., and Markson, L. S.: Multiple idiopathic hemorrhagic sarcoma..... 321
Heller, E. L., and Sieber, W. K.: Fibrosarcoma..... 321
Botsford, T. W., and Tucker, Martha R.: Application of cytologic smear methods to cancer diagnosis in a general hospital. 321
Lees, J. C., and Lees, T. W.: Numerical estimation in cancer and cancer treatment.. 322

RADIATION THERAPY

Ellis, F., *et al.*: Use of wedge filters in x-ray therapy..... 322
Arkin, A. M., and Simon, N.: Radiation scoliosis..... 322
Arkin, A. M., *et al.*: Radiation-induced scoliosis..... 323
Dameshek, W.: Physiopathology and course of polycythemia vera as related to therapy..... 323
Pohle, E. A., and Weissman, I.: Roentgen therapy of Cushing's syndrome (pituitary basophilism)..... 324
Best, M. M., *et al.*: Irradiation of the pituitary gland in hypertensive vascular disease.... 324
Sharp, G. S., Williams, H. F., and Pugh, R. E., Jr.: Irradiation as the preferred treatment of cancer of the lip..... 325
Mallender, L. Janet: Single exposures of superficial x-rays in cancer of the skin..... 326
Teloh, H. A., Mason, M. L., and Wheelock, M. C.: Histopathologic study of radiation injuries of the skin..... 326
Chantraine, H.: Mild roentgen irradiation in sterility..... 327
Meredith, W. J.: Dosage distribution and dosage in carcinoma of the uterine cervix.. 327
Hall, J. E., Pepe, J., and Tortora, J.: Primary uterine malignancy..... 327
Newell, R. R.: Human tolerance for large amounts of radiation..... 328
Overhof, K., and Siekmann, T.: Roentgen therapeutic effect on the bitemporal hemianopsia produced by pituitary tumor.. 328
McDonald, E. J.: X-ray treatment in certain nonmalignant conditions..... 328
Jentzer, A.: Treatment of cancer of the tongue 329
Cutler, M.: Radiotherapy of early cancer of the larynx..... 329
Berkman, A. T.: Postoperative radiotherapy of breast cancers..... 330
Guttmann, Ruth J.: X-ray therapy of primary inoperable carcinoma of the breast. 330

Brachetto-Brian, D.: Bases for the integral treatment of cancer of the breast..... 330
Meyer-Laack, H.: On Sudeck's syndrome and its cure by roentgen therapy..... 331
Naumann, W., and Frank, A.: Critical study of roentgen irradiation of gastric ulcer... 332
Rodé, I.: Attempts to influence the leukemias with blood irradiated *in vitro*..... 333
Levi, L. M., and Engle, R. B.: Radiation therapy of acute pancreatitis..... 333
Cocchi, U.: Therapy of macrofollicular lymphoblastoma (Brill-Symmers disease).... 333
Szellö, F.: X-ray treatment of perineal inflammation in the puerperium..... 334
Ceelen, W.: On roentgen injuries of the intestine..... 334

RADIOISOTOPES

Govaerts, J.: Rate of elimination of C^{14} administered as $BaC^{14}O_3$..... 334
Hertz, S., *et al.:* Analysis of multiple counter technique for the measurement of radioactive sources independent of geometry. 334
Feitelberg, S., *et al.:* Hyperthyroidism..... 335
Meites, J., and Wolterink, L. F.: Uptake of radioactive iodine by the thyroids of underfed rats..... 335
Friedell, M. T., Indeck, W., and Schaffner, F.: Radioactive isotopes in the study of peripheral vascular disease. III. Further evaluation of the diagnostic and therapeutic value of priscoline ®..... 335
Overman, W. J., Gordon, W. H., Jr., and Burch, G. E.: Tracer studies of the urinary excretion of radioactive mercury following oral administration of a mercurial diuretic..... 336
Benjamin, J. A., *et al.:* Radioactive phosphorus (P^{32}) used to study phosphate exchange between urine in the renal pelvis and renal calculi containing phosphate..... 336
Muller, J. H.: First therapeutic results obtained by means of artificial radioactivity 336

CHEMOTHERAPY

Taylor, S., *et al.:* Toxic reactions of 4-aminopteroylglutamic acid (aminopterin) in patients with far-advanced neoplastic disease 337
Caby, F., and Tsevrenis, H.: Treatment of a case of lymphosarcoma of the neck by a combination of nitrogen mustard, roentgen therapy and surgery..... 337

MISCELLANEOUS

Levene, G., and Bragg, E. A., Jr.: Improved type of fluoroscopic foot-switch..... 337
Cole, J. W., Shaw, D. T., and Fraser, P.: Wound healing..... 337
Pollak, O. J., and Leonard, Adeline: Diagnostic value of the iodoacetate index (Huggins-Miller-Jensen test)..... 338
Castex, M. R., Maggi, A. L. C., and Meeroff, M.: Gastric secretion and motility... 338
Lenzi, M., and Magri, G.: Experimental studies on the organo-localisation and following mobilisation of the colloid thorium-dioxide..... 339
Campi, L., and Abeatici, S.: Further experimental investigations on histopathological lesions of the arterial walls caused by organic-iodide compounds used in arteriography..... 339
Rocha, M.: Manuel Estiu test for concretions in the right hypochondrium..... 339
Buchs, S., and Frommherz, G.: Technical apparatus for angiocardiography..... 340
Campbell, J. A., and Lockhart, P. B.: Improved vertical and horizontal multiple cassette changers for contrast angiography 340
McAllister, F. T., and Beck, C. S.: New x-ray technic for visualization of the heart and great vessels..... 340
Macarini, N., and Oliva, L.: Transverse axial stratigraphy in pathological conditions... 340
Paatero, Y. V.: New tomographical method for radiographing curved outer surfaces.. 341
Debain, J. J.: Investigation in the United States on the use of nasopharyngeal radium applicator..... 341
Goldstein, L. A., and Dreisinger, F.: Spot orthoroentgenography..... 342
Moon, H. D., *et al.:* Neoplasms in rats treated with pituitary growth hormone. I. Pulmonary and lymphatic tissues..... 342
Moon, H. D., *et al.:* Neoplasms in rats treated with pituitary growth hormone. II. Adrenal glands..... 342
Grad, B., and Stevens, C. E.: Histological changes produced by a single large injection of radioactive phosphorus (P^{32}) in albino rats and in C_3H mice..... 343
Miller, C. P., Hammond, Carolyn W., and Tompkins, Marianne: Incidence of bacteremia in mice subjected to total body x-radiation..... 343
Rekers, P. E., Coulter, Molly P., and Warren, S. L.: Effect of transplantation of bone marrow into irradiated animals.. 343
Laughlin, J. S., and Davies, W. D.: Procedure in dose distribution measurement of 25-Mev x-rays..... 344
Engström, A., and Glick, D.: Mass of gastric mucosa cells measured by xray absorption 344
Paff, G. H., and Seifter, J.: Effect of hyaluronidase on bone growth in vitro..... 344

ROENTGEN DIAGNOSIS

ABDOMEN

RIPSTEIN, CHARLES B., and MILLER, G. GAVIN. Volvulus of the small intestine. *Surgery*, April, 1950, *27*, 506–511.

The authors report a series of 23 cases in each of which the patient was given a diagnosis of volvulus of the small intestine at operation. A preoperative diagnosis of volvulus of the small intestine was made in 4 instances. Six cases are reported in some detail to illustrate the following points: 1. Volvulus of the small intestine may not be recognized because repeated episodes of twisting and untwisting of the bowel cause intermittent intestinal obstruction. 2. Hematemesis is unusual but it occurred in 2 cases in this series. It is probably caused by extravasation of blood into the lumen of the bowel. 3. If the patient has a "no-loop" gastroenterostomy, the bowel may be twisted around the axis of the superior mesenteric vessels. 4. A foreign body within the lumen of the small intestine may result in volvulus.

Peritoneal adhesions are the commonest cause of volvulus of the small intestine, but patients who have had no previous operation and who have no obvious cause for an obstruction may suffer from volvulus. In one of the authors' cases the cause of the obstruction was an internal hernia through the root of the transverse mesocolon. The pathologic factors are similar in all cases regardless of the cause of the obstruction. The small intestine rotates about the mesenteric axis in a clockwise direction producing venous obstruction which is soon followed by arterial occlusion.

The roentgen features are said to be deceptive, but in about half of the cases the distended loops of small intestine are arranged in an "arcade" pattern. In other cases multiple dilated loops and fluid levels suggest obstruction of the small intestine. The importance of early operation is emphasized. Manipulation under roentgenoscopic control for intubation is condemned because it wastes valuable time.

Clinical features which are suggestive of volvulus include a history of paroxysmal, severe colicky pain associated with vomiting and the observation that the patient seeks to assume a "position of relief" that avoids traction on the mesentery. The authors are of the opinion that the clinical and roentgenologic features should suggest the correct diagnosis in at least half of the cases and should establish the need for urgent laparotomy in most of the remainder.—*C. B. Holman, M.D.*

KEELEY, JOHN L. Intussusception associated with aberrant pancreatic tissue; report of a case and review of the literature. *Arch. Surg.*, April, 1950, *60*, 691–698.

A case of aberrant pancreatic tissue in the bowel with intussusception is reported and the literature of aberrant pancreatic tissue is reviewed. Theories of origin of such tissue are summarized with the conclusion that no generally acceptable explanation has been found. Autopsy incidence indicates that many patients with such abnormality have no symptoms referable to this condition. The association of pancreatic tissue in a Meckel's diverticulum is statistically significant.

The case reported is that of a boy aged three and a half. The symptoms were those of intussusception of approximately three days' duration. Barium enema demonstrated diagnostic defect in the lower ileum. Recovery followed resection of the involved bowel. Pancreatic tissue was in the submucosal layer of the wall of the ileum. This is the seventh reported case of intussusception with intramural aberrant pancreatic tissue as the only regional abnormality.—*D. F. Anderson, M.D.*

TERJUNG, HANS. Über Appendixsteine. (On appendix stones.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1950, *72*, 362–365.

Two cases of chronic appendicitis with radiopaque stones (enteroliths or appendicoliths) are reported. The stones consisted of calcium phosphate and magnesium-ammonium phosphate.

In reviewing the literature, the author found 23 singly reported cases, all of which were associated with chronic appendicitis. In 3,966 operations and autopsies only one case of true appendiceal stone was found. Animal experiments by Beaussenat, "Mühsam *et al.*, showed that foreign bodies placed in the appendix did not result in calculus formation, but were expelled by peristalsis and that concretions found in the appendix were formed in situ. Because of the varied form of appendicoliths, the differential diagnosis is difficult. Urinary tract calculi, phleboliths calcified mesenteric glands, calcifications of vessels, dermoid cysts, calcified appendices epiploicae and wandering gallstones are to be considered.

In closing, the author mentions the possibility of perforation of the appendix by these stones. For this reason, their recognition is important in deciding surgical intervention in chronic appendicitis.—*Salomon Silvera, M.D.*

BERLIN, L., and COTTON, R. Gastro-intestinal manifestations of porphyria. *Am. J. Digest. Dis.*, April, 1950, *17*, 110–114.

The authors report the case of a thirty-two year old profoundly emaciated white male, proved to have porphyria. He suffered from attacks of severe abdominal pain, confusion and polyneuritis. Roentgenographic examination showed overfilling of the esophagus with barium, absence of peristaltic waves and marked delay in emptying. There was lack of gastric peristalsis and the stomach emptied very slowly. By six hours none of the barium had reached

the colon. There was a 50 per cent barium gastric residue in twenty-nine hours. Re-examination three weeks later showed the same initial findings, but the injection of 1 cc. of 1:2,000 prostigmine produced a definite increase of peristalsis.

They conclude that the disturbance of gastrointestinal function in porphyria is probably due to the toxic effect of the porphyrins upon the autonomic nerves.—*A. E. Childe, M.D.*

Rice-Oxley, J. M., and Truelove, Sidney. Complications of ulcerative colitis. *Lancet*, April 1, 1950, *1*, 607–611.

The authors report a series of 129 patients studied during the years of 1938–48. They discuss complications of this disease, listing them as follows:

Cutaneous lesions	12 cases
Arthritis	7
Stricture	7
Fecal fistulae	5
Carcinoma of colon	4
Perforation	4
Stomach ulcers	4
Perirectal abscess	2
Conjunctivitis	2
Prolapsed rectum	1
Biliary cirrhosis	1
Suprarenal hemorrhage	1

Among the cutaneous lesions listed, erythema nodosum and generalized exfoliative erythema have been the most common. Diarrhea and purpura were thought to produce an allergic reaction in response to some separate antigen; thus ulcerative colitis might be an allergic disease. The over-all conclusion is that often the ulcerative disease may be secondary to the above complications.—*R. J. Reeves, M.D.*

Bartley, C. W. Steatorrhoea in a family. *Brit. M. J.*, May 20, 1950, *1*, 1161–1164.

Non-tropical steatorrhea is classified as follows: (1) Celiac disease, and (2) idiopathic steatorrhea which together comprise the great majority of cases and for which no fundamental cause is found at necropsy; (3) a small group of rare cases in which necropsy reveals various causes; (4) a group of children in whom necropsy reveals cystic fibrosis of the pancreas. Among the children reported in this latter group, none survived beyond fourteen and a half years although minor degrees of cystic fibrosis of the pancreas were discovered in children who died from other causes, and did not have steatorrhea.

Celiac disease of children and idiopathic steatorrhea of adults are considered variants of the same disorder and show no familial tendency. Fibrocystic disease of the pancreas, on the other hand, has a high familial incidence. Clinically, the trypsin assay test following duodenal intubation is highly dependable in distinguishing pancreatogenic steatorrhea from the idiopathic types.

In the family reported, the father and 4 of the children had steatorrhea. The ages were 48, 22, 14½, 11 and 9 years. Duodenal intubation was possible in 3 cases resulting in absence of trypsin in 2 instances and a low borderline normal in the third. On the basis of these findings, the author suggests that steatorrhea due to fibrocystic disease of the pancreas may occur in adults.—*G. M. Wyatt, M.D.*

Moreton, Robert D., and Yates, Charles W. The double-contrast study of the colon; a comparative study of barium sulfate preparations. *Radiology*, April, 1950, *54*, 541–547.

The authors present a study of four commercial barium preparations available for double contrast examination of the colon. Comparisons were made on basis of radiopacity, adherence to mucosa, suspension qualities, ease of preparation, toxicity, cost, and end-results. Best results were obtained with either preparations III or IV.—*E. E. Seedorf, M.D.*

Jutras, Albert, and Gernez, André. Visibilité des voies biliaires au cours de l'examen du tube digestif; étude d'ensemble et définition du syndrome; présentation de cas. (Visibility of the biliary ducts in the course of roentgenologic examination of the digestive tract; over-all study and definition of the syndrome; case report.) *Presse méd.*, April 5, 1950, *58*, 357–360.

This is a very detailed study both statistically and technically of roentgen visualization of the biliary ducts by either air or barium and is perhaps the most comprehensive article on this subject to date. This study is by Prof. Jutras and his department at Hotel-Dieu, Montreal.

From statistics based upon the whole literature of this subject the authors draw the following conclusions: (1) Spontaneous visibility of the biliary ducts is a positive sign of organic lesion; (2) internal biliary fistula is more common than it appears to be from postmortem or postoperative reports; (3) cholecystograms demonstrating non-visualization of the gallbladder should always be searched minutely for the possibility of air in the ducts.

Technical conclusions from this article may be listed as follows: (1) The roentgen aspect is simple—demonstration of air or barium in the biliary ducts: (2) Trendelenburg position and having the patient cough often aid in filling the ducts with barium; (3) cases of a typical intestinal obstruction should have a plain survey film over the gallbladder area as well as a survey film of the entire abdomen.

The illustrative roentgenograms, statistical tables and the most complete bibliography to date on this subject make this a remarkable reference article.—*W. M. Loehr, M.D.*

Gynecology and Obstetrics

Hildreth, R. C., and Chrest, C. P. Uterogram in sterility. *J. Michigan M. Soc.*, April, 1950, *49*, 431–434.

A series of 309 cases were studied and of this group 50 per cent were reported as abnormal. The examinations were carried out as an office procedure, the study being done primarily for aid in the study of sterility.

The causes of sterility are listed and discussed. Chronic endocervicitis was the most common finding and the characteristic roentgen changes were deep pockets extending transversely from a dilated and slightly elongated cervical canal giving it a serrated appearance.

Occlusion of both tubes comprised the next largest group and two-thirds of the patients had the point of occlusion at the fimbriated end, with the usual hydrosalpinx formation.

The third group comprised the developmental anomalies, tumors and miscellaneous lesions.

The therapeutic effect of this procedure is stressed, the effect being due to the opening of the previously occluded tube by mechanical or hydraulic force, the breaking up of fine adhesions, the straightening of tube kinks and propulsion of inflammatory debris with minor effort at injection. Untoward complications were rare and there were no deaths.

The authors stress the importance of fluoroscopy in preventing complications.—*J. G. Snead, M.D.*

Maršálek, Jan. Hysterosalpingographie mit nachfolgender Hydropertubation. (Hysterosalpingography with subsequent hydropertubation.) *Schweiz. med. Wchnschr.*, May 13, 1950, *80*, 498–499.

Instead of a 40 per cent, author uses a 20 per cent lipiodol solution, since it has been shown that the former solution because of its high viscosity passes with great difficulty through the fallopian tubes having narrow lumens. For this reason many authors have stopped using oily solutions of contrast material and employ aqueous solutions. Thus, 50 per cent perabrodil (diodrast) was tried by Kjellberg, who was able to outline large hydrosalpinges as well as to diagnose tumors and adhesions in the pelvis. The aqueous solutions could also be used in the presence of metrorrhagia, since even when they entered the blood vessels, they became mixed with the blood so that one did not fear the danger of emboli.

The use of oily contrast material produces several difficulties. By increasing the pressure in the cannula one can influence mechanically the passage of the oil, but when the lumen of the fallopian tube is narrow and, owing to the great viscosity of the material, the lumen is not filled completely, a false diagnosis may be made. A second difficulty arises when there is atony of the ampullar portion of the tube: the oil accumulates and dilates this portion, then runs quickly into the abdomen. A repeat examination is necessary to rule out the possibility of hydrosalpinx or adhesions in the region of the ampulla. At other times, the oil stops at the ampulla, requiring re-examination some hours later.

The author inserts a round piece of wood, having a lead cap at the end, into the rectum so that he may exert pressure upon the contrast material in the ampulla of the tubes to force it into the pelvis. The mere ability to move the ampulla is of diagnostic value. If the oil does not enter the tubes as seen fluoroscopically, he increases the pressure in the cannula slightly; if at the end of two minutes the tubes are not filled, he removes the syringe from the cannula, allows one-half of the oil in the uterus to leak out, and with another syringe injects 20 cc. of normal saline containing 10,000 units of penicillin. The oil becomes diluted and even if the interstitial portion of the tubes is narrowed markedly, he still succeeds in outlining these parts.

When the contrast material stagnates in the ampulla of the tube, the author concerns himself first with the mobility of the ampulla and takes pains to force with the aid of the rectal insert the oil into the abdomen. If this procedure fails, he attempts to suck out the oil from the uterus, after which he replaces the oil syringe with that containing the penicillin mixture and injects this latter substance slowly into the uterus. Should a hydrosalpinx be present, it will be filled out completely and the diagnosis can be made easily because of its sausage shape and sharply outlined margins. If there is an atonic ampulla, the oil will be swept into the abdomen by the penicillin solution. To be certain that the tubes are entirely patent one must determine fluoroscopically that the contrast material reaches the cul-de-sac. In case of non-visualization the author has no hesitancy in injecting another 20 cc. of the penicillin mixture. The diagnosis of adhesions about the ampulla is made only when the penicillin mixture does not force the contrast material into the cul-de-sac and when an increase in resistance is felt on repeated injection of the penicillin mixture. The largest amount of the penicillin mixture the author ever used was 60 cc. and this produced no noticeable reaction.

The advantages of the combination of hysterosalpingography with hydropertubation are: (1) The determination of tube patency even in a relatively narrowed lumen. (2) Comparatively simple establishment of peri-ampullar adhesions. (3) The full size of large sac-like hydrosalpinges may be made out. (4) In most instances, one examination suffices for such a controlled hysterosalpingography.—*Samuel Richman, M.D.*

Reicher, N. B., Massey, B. W., and Bechtold, E. A clinical evaluation of 3500

vaginal cytologic studies. *Am. J. Obst. & Gynec.*, April, 1950, *59*, 860–866.

In an effort to answer the question "How much help can one expect from the vaginal smear as related to the diagnosis of cancer of the female genital organs?" the authors made an analysis of their own cases over a fifteen month period, during which time 3,500 vaginal smears were made. Eighty-five cases of carcinoma of the uterus, cervix, vagina, or vulva were discovered. There was a false negative error of 27.8 per cent in the 18 cases of adenocarcinoma. In addition 6 smears were mistakenly called adenocarcinoma, making a false positive error of 31.6 per cent. In 67 cases of squamous carcinoma, there were 4 false negative smears, or a false negative error of 5.9 per cent, and there were 11 false positive smears, or an error of 14.9 per cent.

The authors emphasize that it is important to be critical of the method of computation when judging the percentage evaluation of the accuracy of any clinical examination. In this study, if the percentage of errors had been computed upon the basis of 3,500 examinations, the error would have been only 0.74 per cent.

They conclude that the vaginal smear has not been, and will not be the basis of gynecological surgery or the reason for not employing surgery until all other diagnostic criteria have been met.—*J. H. Harris, M.D.*

Gold, Edwin M. "Pelvic drive" in obstetrics; an x-ray study of 100 cases. *Am. J. Obst. & Gynec.*, April, 1950, *59*, 890–896.

In studying the mechanism of labor in 100 patients, according to the Caldwell-Moloy technique, the author found that three positions of the fetal back in relation to the maternal vertebral column on roentgen pelvimetry are associated with three directions of pelvic drive and three different "drive-angles." The direction of the pelvic drive is toward the posterior, midpelvis, or forepelvis, while the "drive-angle" is determined by the relation of the position of the fetal back to the maternal vertebral column. When the "drive-angle" approaches 90 degrees, the drive is into the posterior pelvis, when it approaches 45 degrees, the drive is into the middle pelvis, and when the "drive-angle" tends to parallel the maternal spine the drive is into the forepelvis. The author believes that the fascial attachments of the lower uterine segment and the cervix, direct the presenting part into the fore, middle, or posterior pelvis. Pelvic morphology also plays a role, since in android and platypelloid pelves as the fetal back is displaced posteriorly and the pelvic drive becomes forepelvic the "drive-angle" becomes acute. Duration of labor increases as the drive and "drive-angle" become more abnormal.

The authors feel that evaluation of drive and "drive-angle" should be included in the roentgen interpretation as these factors prognosticate the prolongation of labor, decrease in incidence of spontaneous and low forceps delivery and increase in incidence of mid forceps and cesarean section as one goes from posterior pelvic to forepelvic drive and their respective "drive-angles."—*F. B. Markunas, M.D.*

Corner, G. W., Jr., Hu, Chih-Yuan, and Hertig, A. T. Ovarian carcinoma arising in endometriosis. *Am. J. Obst. & Gynec.*, April, 1950, *59*, 760–774.

This article is a study of 265 cases of ovarian malignancy and 889 microscopically proved cases of ovarian endometriosis found at the Free Hospital for Women, at Brookline, Mass., in the period from 1903 to 1947. The survey was made to study the relation between the two conditions. It is a pathological study with several detailed case reports and photomicrographs.

It is concluded that proved cases of carcinoma arising in endometriosis are exceedingly rare. Only 3 undoubted cases were found in the entire series. Carcinoma may arise in association with endometriosis in two ways: (1) by malignant changes in the non-endometrial portions of the mixed cysts, and (2) by malignant transformation of the endometriosis.—*J. H. Harris, M.D.*

Delascio, Domingos, and Guariento, Antonio. Neoplasmas do ovário e gravidez. (Neoplasms of the ovary and pregnancy.) *Rev. de ginec. e d'obst.*, April, 1950, *44*, 213–248.

During the last few years the authors observed a number of cases of ovarian tumors associated with pregnancy, a fact which induced them to make a detailed study of this subject. They have reviewed no less than 221 articles from the literature and in the present paper they compile the findings of their analysis by paying special attention to the various clinical, pathological and therapeutic features.

The first case of an association of ovarian tumor with pregnancy was presented by Schamberg as far back as 1707. It remained for Merriman, however, to report in 1812 the first larger group of cases, all of which had ovarian cysts complicated by pregnancy. In later publications numerous authors dealt with quite large series of cases comprising all varieties of ovarian tumors, the largest being that of McKerron who was able to collect 720 cases from the literature and personal observation. In McKerron's series the rate of the maternal mortality amounted to 21 per cent and of the fetal mortality to 50 per cent.

The incidence of pregnancy associated with ovarian tumors in relation to uncomplicated normal pregnancy is given by the different authors of the world literature as varying between 0.03 and 5 per

cent, the highest figures being reported by Martin (1.5 per cent), Gorizontov (2.8 per cent) and Liebman (5 per cent).

The most common histopathologic forms encountered in McKerron's series were: simple and multilocular cysts (68 per cent), dermoids (23 per cent), malignant neoplasms (5 per cent) and solitary adenomas and fibromas (2 per cent). The same proportional distribution was reflected in most of the other large series. In a few, however, the dermoids appeared more predominant than the simple and multilocular cysts. In studying the relative frequency of the various cysts in pregnancy as compared with their occurrence in non-pregnant women, the authors noted that the corpus luteum cysts and the dermoids had an unusually high incidence, indicating great hormonal influence. The incidence of dysgerminoma and chorionepithelioma was likewise somewhat higher but the granulosa cell tumor was observed very seldom. Paradoxically, occasional cases of arrhenoblastoma which occurred in conjunction with pregnancy were also described. As regards the malignant tumors no reliable statistics were found to prove or disprove their causative relationship with pregnancy in uniparous or multiparous women although an increase in size may take place in any tumor during the course of pregnancy.

The authors list the following complications which may result from the influence of pregnancy on the ovarian tumors: (1) increase in volume due to hormonal stimulation or simply to the increased blood exchange characteristic of pregnancy; (2) torsion of the pedicle which according to Remy occurs in 61 per cent of the cases, usually during the first half of pregnancy but also during the puerperium when the intra-abdominal pressure is suddenly lowered; (3) intracystic hemorrhage, with or without torsion of the pedicle; (4) rotation of the tumor which may occur in less than 5 per cent of the cases at any time during pregnancy but is somewhat more frequent in the puerperium; (5) suppuration and necrosis in 5–11 per cent of the cases, and (6) malignant degeneration which is exceptional.

The authors discuss in considerable detail the influence of the tumor on the course of pregnancy and puerperium, the effect of unilateral and bilateral oophorectomy on the interruption of pregnancy, the symptomatology and differential diagnosis of ovarian tumors associated with pregnancy.

The treatment is surgical. The experience gained in removing ovarian cysts or performing oophorectomies during pregnancy justifies certain very definite conclusions. These are: (1) the usual postoperative complications of ovarian tumors occur a little more frequently in pregnant than non-pregnant women; (2) oophorectomy is indicated whenever the ovarian tumor endangers the mother's life; (3) removal of the corpus luteum containing ovary during the first three months of pregnancy can produce abortion; (4) when an oophorectomy has been performed ante partum and the pregnancy has progressed to term cesarean section is indicated to prevent rupture of the fresh laparotomy scar during labor; and (5) the performance of oophorectomy creates no special problems in the post partum period.—*T. Leucutia, M.D.*

Genitourinary System

Harrison, F. G., Warres, H. L., and Fust, J. A. Neuroblastoma involving the urinary tract. *J. Urol.*, April, 1950, *63*, 598–612.

The authors report in detail 8 cases of neuroblastoma involving the urinary tract. A few illustrative films are included to show the displacement and distortion of the kidney which may occur with these tumors.

Most neuroblastomas originate in the adrenal gland medulla or in abdominal sympathetic ganglia. The tumor is essentially one of infancy and childhood. Confusion between this tumor and Wilms' tumor of the kidney is frequent. These tumors often metastasize to the bones, especially of the skull. Metastasis may also be by way of the blood stream or lymphatics. Pallor, anemia, joint pains and fever are common symptoms.

The roentgen diagnosis is based on the finding of fine flaky calcifications in a tumor mass displacing the kidney. Occasionally spider-like distortion of the pelvis and calyces of the kidney occurs. Bone metastases are usually destructive in type. Farber's conclusions as to the course of the disease are: (1) that it may undergo spontaneous hemorrhage and necrosis and disappear with no treatment; (2) that it may undergo spontaneous maturation to become a benign ganglioneuroma; and (3) that it may be inactivated by irradiation even after metastases have occurred.

The authors favor early surgery with postoperative roentgen therapy in treatment of the disease. The pathology of the tumors is discussed in some detail.—*R. M. Harvey, M.D.*

Sporer, Andrew, and Greenberger, Monroe E. Experimental studies on the pathogenesis and prognosis of renal tuberculosis. *Am. Rev. Tuberc.*, April, 1950, *61*, 508–517.

The nature of hematogenous infection of the kidney has been studied by injecting animals to see whether there was any predilection for seeding into various organs. Diseased and traumatized areas developed tuberculosis earlier than non-traumatized tissues.

However, at Sea View Hospital, 11 patients with pulmonary or osseous tuberculosis who had kidney injury were observed, and none developed kidney tuberculosis.

Experimental data have been presented by Uffredazzi and others to show that removal of one

kidney benefits bilateral renal tuberculosis. Experimental animal studies and clinical studies were conducted at Sea View Hospital to clarify this point.

The conclusions, on both the experimental and clinical studies, were that nephrectomy in cases of bilateral disease does not promote healing. The survival period of such a patient depends on the amount of remaining functioning kidney tissue.

There are several indications for nephrectomy in the presence of bilateral disease: pyonephrosis with fever uncontrolled by conservative measures, uncontrolled bleeding, and severe pain. In all of these, however, the nephrectomy is done to cope with the specific problem, and not to benefit the other kidney.—*Lois Cowan Collins, M.D.*

Lattimer, John K., Amberson, J. Burns, and Braham, Stanley. The streptomycin treatment of genitourinary tuberculosis. *Am. Rev. Tuberc.*, April, 1950, *61*, 518–524.

An analysis of 253 cases of genitourinary tuberculosis treated by streptomycin alone showed that it was sufficiently effective to be useful against bilateral renal tuberculosis, tuberculosis in a solitary kidney, and selected small unilateral tuberculous kidney lesions.

"Small" lesions are defined as those which are not visible on pyelograms, although detectable by bacteriologic examination of the urine. Such cases are rarely seen in urological practice, except where a tuberculous kidney has been removed and the "good" kidney is kept under observation. Such lesions may be recognized if patients with pulmonary tuberculosis are kept under close observation for urinary symptoms. These small lesions showed the best response to treatment.

Any lesion sufficient to be recognizable on pyelograms was considered "large," even if only one calyx was involved, because it was assumed to contain necrotic and fibrous tissue. Caseation, necrosis, and fibrous tissue were the chief factors limiting the effectiveness of streptomycin. In the presence of a "large" lesion of one kidney, surgery was considered the treatment of choice, and streptomycin treatment was used for three weeks at the time of operation. If evidence of tuberculosis developed subsequently in the remaining kidney, streptomycin treatment was instituted.

In the presence of bilateral disease, streptomycin is the treatment of choice. Even patients in whom the urine did not become negative for the tubercle bacillus were often clinically improved.

Superficial ulcerations and edema of the bladder and ureters responded well, but contracted bladders and strictures did not improve. Prostatic and epididymal tuberculosis did not respond sufficiently well to merit treatment by this method.—*Lois Cowan Collins, M.D.*

Alken, C. E. Die Dyskinese der ableitenden Harnwege. (Dyskinesis of the kidney pelvis and ureter.) *Neue med. Welt*, May 13, 1950, *1*, 669–672.

This is a temporary disturbance of the function of the smooth muscles of the kidney pelvis and ureter, accompanied by spasms or atonia and colicky pain of varying intensity.

Two forms are observed: (1) a primary, neurogenic, mostly spastic form, found in individuals with lability of the neurovegetative system; (2) a secondary, inflammatory form, spastic on the onset and changing into atonia later. The first form is clinically characterized by attacks of colic of short duration, accompanied by slight hematuria. The second, more frequent form, manifests itself by attacks of colic, slight bacteriuria and pyuria. The most frequent etiological factor is focal infection.

On roentgen examination, the intravenous pyelograms are usually normal. After retrograde injection of the dye, pyeloscopy and spot films show hypo- or hyperperistalsis, temporary or lasting spasms or atonia.

Therapy is peridural anesthesia of the corresponding segment, spasmolytics and local warm applications. In the inflammatory form, foci of infection must be removed, antibiotics and usual medical treatment used.

This new clinical entity may help to explain many unclear renal colics without detectable stones.—*K. F. Metzinger, M.D.*

Günther, G. W. Morphologie und Symptomatologie der Nierentumoren. (Morphology and symptomatology of the renal tumors.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, May, 1950, *73*, 30–42.

The author presents examples of five different types of renal tumors:

1. A tumor of the kidney without pain and without abnormal findings in the urine.
2. A tumor of the kidney with pain and hematuria due to pressure of the tumor upon the kidney pelvis and the ureter.
3. Large renal tumor with extension of the tumor into the kidney pelvis or calyces and with colicky pain.
4. A tumor of the kidney without pain, but with hematuria due to secondary pyelitis.
5. A renal tumor with hematuria due to secondary pyelitis and thrombosis of the renal vein.

The author believes that a renal tumor does not cause pain per se. Pain is caused only by the contractions of the muscles of the kidney pelvis or the ureter. Hematuria is not necessarily explained by the demonstration of a renal tumor. A renal tumor, regardless of its size, bleeds only when extending into the calyces or kidney pelvis. A hematuria even in

the presence of a tumor is due to secondary pyelitis if the tumor does not extend into the excretory system.—*H. P. Mueller, M.D.*

HAWKINS, C. F., and SMITH, O. E. Renal dysplasia in a family with multiple hereditary abnormalities including iliac horns. *Lancet*, April 29, 1950, *1*, 803–808.

A type of renal dysplasia is described which presents the same clinical picture as chronic glomerular nephritis. Thus there is persistent albuminuria with casts of all types and occasional red blood cells. Renal function is slightly diminished and roentgenograms show kidney shadows of normal size and shape.

The various members of the family also possessed a great number of congenital abnormalities affecting tissues both of ectodermal and mesodermal origin. The commonest trait involves the fingernails, elbow-joints, and patellae and is known by the family to have been inherited from distant ancestors. Many who have this triad also show other changes affecting the skin, vertebral column, and pelvis.

A particular study has been made of iliac horns, because these have hitherto had scant attention and have not been demonstrated as a hereditary characteristic. Nine members of a family were found to have these structures which were unsuspected by the patient. The processes, if well developed, formed a slight visible elevation in the smooth contour of the buttock, and could otherwise be easily palpated beneath the gluteal muscles, about 8 cm. below the iliac crests and between 5 and 14 cm. from the midline according to their length. The larger ones were striking features on the roentgenograms, whereas the rudimentary "horns" appeared as a small but characteristic pattern in the center of the ilium, a feature that could easily be missed unless attention was directed to the possibility of their presence. They were easily visible on the roentgenogram of a boy aged nine months, and terminal epiphyses were seen on the iliac horns of a girl aged fourteen years. It is thought that the detailed analysis of so many widely scattered developmental errors may in the distant future be of some value in preparing a map of the human chromosome.—*E. J. McDonald, M.D.*

WEYRAUCH, H. M., and FLEMING, A. E. Congenital hydrocalycosis: hydrocalycosis of a single renal calyx in a newborn infant with complete destruction of the kidney. *J. Urol.*, April, 1950, *63*, 582–587.

This case is reported because of an unusual cause of a large retroperitoneal mass in infancy. The preoperative diagnosis was hydronephrosis based on the pyelographic findings of laking of the opaque medium to form a crescentic shadow in the lower pole of the involved kidney. At operation a huge globular cystic mass was found which proved histologically to be hydrocalycosis of a single renal calyx. The rest of the renal parenchyma showed almost complete atrophy.

The common causes of hydrocalycosis are renal calculus, fibrosis of the infundibula, and congenital narrowing. A schematic illustration of the mechanism of the replacement of the kidney substance by an enlarging hydrocalycosis is presented.

The authors were able to find no other case report of a single calyx being occluded and leading to complete destruction of the rest of the kidney. Communication of the cyst with the renal pelvis rules out the possibility of the case representing a large renal cyst.—*R. M. Harvey, M.D.*

SIMRIL, W. A., and ROSE, D. K. Replacement lipomatosis and its simulation of renal tumors; report of two cases. *J. Urol.*, April, 1950, *63*, 588–592.

This report is of interest because it describes a benign condition which simulates a malignant one. The condition is rare and is to be distinguished from true perirenal lipomas or true intrarenal lipomas. Replacement lipomatosis apparently takes the place of destroyed renal parenchyma by atrophic or necrotic processes. The condition is almost always unilateral. No cases have been diagnosed preoperatively.

The presumptive diagnostic signs have been pointed out by Roth and Davidson and are: chronic renal infection, calculi, poor renal function on one side, and a filling defect in the pyelogram of the same side. It is almost impossible to exclude tumor and in all cases a nephrectomy is essential to exclude malignant tumor. Illustrative pyelograms are presented to show the similarity of the pyelographic findings to those in malignancy.—*R. M. Harvey, M.D.*

GÜNTHER, G. W. Pyelographische Fehldeutungen und Nephrektomie bei "essentieller" Hämaturie. (Nephrectomy in "essential" hematuria due to the misinterpretation of pyelograms.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, May, 1950, *73*, 42–54.

The author warns against early and ambitious surgery, particularly nephrectomy in cases of hematuria with questionable or minimal findings on pyelographic studies. Misinterpretation of pyelograms are common under three conditions: (1) due to congenital abnormalities, particularly in cases of giant calyces and caliceal diverticula; (2) due to overfilling of the calyces, extravasation of dye or other artificial abnormalities caused by the examination; (3) due to either organic or functional filling defects misinterpreted as tuberculosis or tumors.

The author recommends conservative treatment, observation and repeat pyelographic studies in doubtful cases. He does not believe that the possible

danger of extension or metastasis outweighs a moderate delay in surgery under questionable findings since it is usually only the early or small lesions in which findings are controversial.—*H. P. Mueller, M.D.*

Edling, Nils P. G. Die Darstellung der Harnröhre und der Harnblase mittels wasserlöslicher Kontrastmittel. (The demonstration of the urethra and the bladder by means of water soluble contrast medium.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, May, 1950, *73*, 18–29.

The author believes that urethra, prostate and bladder represent a functional unit during filling and emptying of the bladder. He recommends therefore a urethrocystography with water soluble contrast medium of the abrodil type which allows a simultaneous study of urethra, prostate and bladder.

Because of the irritating effect of the water soluble media, the author suggests anesthesia of the urethra. No other ill effects were noted. The use of the water soluble contrast medium is superior to that of oily solutions because it mixes easier and quicker with the urine in the bladder. Films must be taken during injection, after injection and during urination in various positions to make an examination complete and satisfactory.

The examination is recommended for the diagnosis of diseases of the bladder, of congenital malformations, the localization of strictures, the recognition of inflammatory changes and formation of fistulas in the urethra and for the demonstration of the seminal vesicles and ducts.

Such an examination can also be of great value in the differential diagnosis of prostatic diseases, such as prostatitis, atrophy, hypertrophy and carcinoma, all of which can lead to characteristic and different deformities of the urethra.

The examination is of particular value in male patients, but may be of significance also in females, particularly in the diagnosis of incontinence.—*H. P. Mueller, M.D.*

Dean, A. L., and Ash, J. E. Study of the bladder tumors in the Registry of the American Urological Association. *J. Urol.*, April, 1950, *63*, 618–621.

This article is an attempt to present tabulated material on the cases of bladder tumor in the Registry of the American Urological Association. All registered tumors are analyzed as to type, sex, age distribution, grade, treatment methods, and survival rates. Over 5,000 tumors are registered, 2,242 of which are still surviving, 620 for more than five years. The statistics are just being brought up to date after lapsing during the war years.—*R. M. Harvey, M.D.*

Nervous System

Camp, John D. Contrast myelography past and present. *Radiology*, April, 1950, *54*, 477–506.

This paper, given as the annual Carman Lecture, is a comprehensive review and analysis of contrast myelography.

Dandy, in 1919, observed that air would outline the spinal cord and predicted that localization of spinal cord tumors would be possible by this method. Wideröe, in 1921, gave the first report of a spinal cord tumor localized by air injection into the spinal subarachnoid space. Sicard and Forestier introduced the use of lipiodol as a contrast medium for the diagnosis of spinal cord abnormalities in 1922. Objections to lipiodol because of its irritating effect on the meninges began to be advanced and there was a temporary swing back to the use of air as a contrast medium.

In 1944 pantopaque was introduced by Ramsey, French, and Strain and is still the medium of choice in this country. Skiodan, a water soluble opaque substance, is the medium of choice in Europe.

Camp recommends air myelography for the lumbar spinal canal area but emphasizes that only the experienced examiner can hope to obtain the accuracy possible with pantopaque. The author also states that in his experience more accurate information is yielded by lipiodol as compared to pantopaque. The only advantage of pantopaque is the ease with which it can be withdrawn from the spinal canal.

In Camp's series, 4 per cent of all tumors diagnosed by myelography have been multiple as are 18 per cent of all intervertebral disc protrusions.

The myelographic characteristics of tumors, varices, and protruded discs are given in detail and extremely well illustrated. Sources of error are listed as follows:

1. Insufficient contrast medium (small, multiple or atypical lesions may be overlooked).

2. Improper injection of the medium (false defects due to multiple punctures of the dura or extradural injection).

3. Inadequate scope of examination (lower dorsal lesions may clinically simulate low lumbar disc protrusions).

4. Handicaps due to deformities of the spinal column or inadequate apparatus (extreme pain, kyphosis, paralysis may prevent complete study).

5. Pseudo defects produced by tip of lumbar puncture needle. (Defect may be due to displaced nerve and therefore disappear after needle is withdrawn but local hemorrhage will persist and make differential diagnosis impossible.)

6. Anatomic variations of the cul-de-sac (narrow canal or short sac so the protruded disc or tumor does not impinge on the oil-filled canal).

7. Concealed or central discs. (These may give

no roentgenologic findings and hyperextension has not helped in their demonstration.)

8. Enlarged epidural veins, various atypical deformities of the canal outline due to previous surgery and a miscount of the lumbar vertebrae are other sources of error.

The apparent need is for a satisfactory absorbable medium which will consistently outline the intradural portions of the nerve roots as well as the subarachnoid space.—*C. A. Stevenson, M.D.*

Skeletal System

Roth, H. Zur Frage der "bone bank." (On the problem of the "bone bank.") *Schweiz. med. Wchnschr.*, April 8, 1950, *80*, 345–347.

Stimulated by the successful preservation of food and other perishable substances, as well as by the increasing number of blood banks and cornea banks, it was natural to start experimentation with bone. Furthermore the use of autogenous bone prolonged operation time, increased morbidity and promoted complicating factors. Homogenous bone, too, has certain disadvantages: (1) donors are not always available; (2) inflammatory changes are more frequent than with autogenous bone; (3) reactions to foreign proteins are likely. In attempting to overcome the latter difficulty, early experimenters included: (1) preparatory parabiosis (reciprocal continuous transfusions) to intermingle the blood of donor and recipient; (2) protein injections from donor to recipient, and vice versa; (3) various chemicals to block the reticulo-endothelial system. None of these was of practical value. Orell's "os purum" (pure bone) consisted of macerated bone, free of fat and protein, but while it resisted disintegration for a long time, it had no osteogenetic properties. The results with alloplasty (the use of such substances as elephant tusk, cork, rubber, plexiglass, etc.) were also poor because: (1) a capsule formed about the material to prevent union with host bone; (2) the material would succumb easily to trauma or infection and slough out; (3) pseudarthroses developed.

Many questions remain unanswered. What is the optimum temperature for the freezing cabinet? Should there be quick or gradual cooling? Which is the best medium: air, citrated blood, plasma? The author prefers quick cooling at −40°C. in liquid paraffin.

Preserved bone was used in 52 operations. Among these were 12 spinal fusions, 6 graft-arthrodeses of the hip, and 7 pseudarthroses of long bones. While the author warns that it is too early to draw conclusions, he states that no infections have occurred and the results are good thus far. Strict asepsis and accurate immobilization are of paramount importance. Freezing the bone probably accounts for the destruction of individual-specific proteins.—*J. Zausner, M.D.*

Lemahieu, S. F. Le gargöilisme. (Gargoylism.) *J. belge de radiol.*, Dec., 1949, *32*, 214–229.

This is a review of Hurler's syndrome with the presentation of a new case. This syndrome was first described in 1919. Ellis described four main findings: chondro-osteodystrophy, corneal opacities, hepatosplenomegaly, and mental retardation. Tuthill discovered an abnormal lipoid at autopsy in one case in the brain. This was confirmed by others who also found this substance in other organs. About 100 cases have been reported chiefly in the Anglo-Saxon literature. The lesion is congenital, rarely familial, and of unknown etiology. It is a progressive disease appearing in the first year of life and characterized by a generalized and symmetrical dysostosis resulting in a disproportionate dwarf with a large head, a swollen and grotesque appearance, gross and ugly features, short neck, distended abdomen, and dorsolumbar kyphosis. There is a distinct hepatosplenomegaly, mental retardation almost to complete idiocy, bilateral corneal opacities, and often limitation of movements and stiff joints.

The disease is classified with the group of mixed osteochondrodystrophies with changes in enchondral and periosteal ossification. The skeletal lesion is somewhat similar to Morquio's chondrodystrophy. The affection is also grouped with the lipoidoses similar to Tay-Sachs' amaurotic idiocy but the association with the skeletal change is not constant.

Roentgenological examination of the suckling shows few anomalies, but by the time the infant reaches the age of one or two years, pathognomonic signs may be found. The most characteristic changes are in the spine, the hands, and the skull. A typical dorsolumbar kyphosis seems to result from a selective hypoplasia of the anterior-superior portion of the vertebral body which then appears wedge-shaped. This may produce a rocking movement of the vertebra or even spondylolisthesis since the intervertebral articulations are equally hypoplastic. There is localization in the lower dorsal and upper lumbar spine.

The long bones of the upper extremity are massive. Often they show a central fusiform swelling, tapering towards the ends. This is contrary to what is seen in fetal chondrodystrophy. It results from medullary swelling, the cortex remaining normal or, rarely, thickened. Often the bones are almost cuboid. There may be cartilaginous excrescences as in chondromatosis or periosteal thickening at the muscle insertions. The epiphyses of the long bones are delayed in appearance and unite late. They are atrophic and shrunken. In contrast, the primary nuclei of the short bones of the carpus and tarsus often show only slight retardation. Marked retardation is more often a sign of hypothyroidism.

The thorax may be mildly deformed (pectus carinatum) but not to the degree seen in Morquio's disease. The ribs are contracted at their vertebral

articulations and then widen progressively in the form of a palette. The clavicles are equally thick, sometimes even more than the extremities. The coracoid apophyses are sometimes poorly developed while the glenoid cavities are very little excavated. The humeral diaphysis is grossly formed particularly in its proximal portion. The head of the humerus forms a more acute angle than normal with the diaphysis, even up to a right angle. The bones of the forearms are massive and are irregular at their ends particularly at the wrist. The epiphyseal lines are oblique and converge toward each other. Chondromatous projections are not rare.

The bones of the hand are very characteristic. The metacarpals and phalanges are short and squat with exaggerated trabeculation. They are wide at their epiphyseal extremities and taper toward the other end. Thus the second to the fifth metacarpals with a rather angular appearance have an irregularly tapered proximal end while the other bones with a rather curved appearance are narrowed distally and look like suppositories.

The skull is increased in volume and shows a general dolichocephalic deformity with a tendency to scaphocephaly. The frontal bone is markedly developed and is convex forward with marked supraorbital ridges. Frequently the vascular grooves are exaggerated. Closure of the frontoparietal suture and the large fontanelle are delayed. Some degree of hydrocephaly is not unusual. Bradycephaly also is encountered. The bones at the base of the skull seem completely inhibited in their development and this is reflected in the facial bones which seem to be piled up. The sella turcica is equally deformed, elongated and a little deep with the clinoids irregular. The inferior maxilla may be hypertrophied. Pneumatization of the mastoids is practically lacking and development of the sinuses is inhibited. The roentgen appearance of the lower extremities is much less characteristic. The ischiopubic arches are often poorly developed. There is often a subluxation at the acetabula. When the femoral neck is almost vertical, there is marked coxa valga. Rarely, there is coxa vara with deformity of the head and marked deepening of the acetabula. Generally there is genu valgum and pes planus. Chondromatous exostoses may be present.

Differential diagnosis is primarily roentgenological. In fetal chondrodystrophy or achondroplasia, enchondral growth is markedly curbed resulting in a particular type of dwarf. Thus the long bones are short and massive. They are wide particularly at the epiphyses which surmount the bones. The apophyses on which there are muscle insertions jut out. There are hypo- and hyperplastic forms, depending on whether the hypertrophied epiphyses are smooth or knotty with exostoses.

Morquio's disease or atypical chondrodystrophy seems to be a variation of hyperplastic chondrodystrophy with osteomalacic deformities of the skeleton. Marked deformity of the thorax is present which is lacking in achondroplasia. The lower extremities are involved more than the upper. The skull is normal. Almost all of the vertebrae are involved. The acetabula are deepened with coxa vara deformity. There is excessive laxity of the joints. There is a familial trend. The others are dyschondroplasia and chondrodysplasia where there is cartilaginous proliferation either toward the interior of the diaphysis (Ollier's disease) or externally with ossification (multiple chondromatous exostoses). There is no disproportionate dwarfism.

Familial plenostosis of Léri affects chiefly the extremities. The arms are fixed in internal rotation while the forearms are in pronation. The fingers are ankylosed in flexion. The legs are stiffened in external rotation. Aside from a claw-like hand and a marked limitation in movements, the disease has nothing in common with gargoylism. Roentgenologically, there is excessive bone formation not only of the diaphyses but also of the epiphyses which in gargoylism tend to be atrophic. There is early diaphyseal-epiphyseal closure as in achondroplasia.

The polyosteochondritis of R. Clement consists of marked epiphyseal changes. The epiphyseal ends are fragmented and flattened, the fringed epiphyses are badly developed and the conjugating cartilage is irregular. The epiphyseal deformities are the reason for non-painful joint difficulties. A certain degree of dwarfism is produced.

In none of these affections is there any hepatosplenomegaly, corneal opacities, or mental change.

Infantile myxedema is characterized by absence of kyphosis, the skin is rough and thick, there is hypotrichosis and the eyes are normal in most cases. There is no true bone deformity but there is marked retardation. Mongols have atypical facies, a general hypotonicity of the joints, microcephaly of the bradycephalic type. Ossification is retarded. Well advanced rickets can give rise to a disproportionate dwarf and to bony deformities resulting from retarded ossification and osteomalacia.—*M. L. Sussman, M.D.*

Clara, R., and Thys, L. La lipochondrodystrophie (gargoïlisme, maladie de Hurler, maladie de Pfaundler-Hurler, etc.). (Lipochondrodystrophy [gargoylism, Hurler's disease, Pfaundler-Hurler's disease, etc.]) *J. belge de radiol.*, Dec., 1949, *32*, 230–248.

This is the report of a typical case of Hurler's disease. In view of the article which precedes this, there is no need to repeat the details. However, a chart (see page 306) which tabulates differential diagnosis seems worthy of reproduction.

Heredity as an etiological factor is discussed. Parents are apparently normal. If there is a hereditary factor, it is recessive. In many cases the parents are blood relations. Often the affection is familial.

Hurler	Morquio	Cretinism	Achondroplasia	Mongolian Idiocy
Dwarfism	Dwarfism	Dwarfism	Disproport. dwarf	Small size
Gargoylism	Hunchback	—	—	Flat face full moon
Large head	Normal head	—	Large head	Small head
Persistent large fontanelle	Normal head	Dwarfism	—	No cranial ossification
Flat nose	Normal head	Dwarfism	Large head	No cranial ossification
Flattened sella turcica	Small sella	—	Normal sella	—
Microdontia	Normal dentition	Dentition retard; macrog.	Dentition normal	Gaping mouth
Macroglossia				
Lumbar kyphosis	Generalized	—	Lumbar saddle deformity	—
Post. luxation L_1 or L_2	Platyspondyly Flat vertebrae			
Thick clavicle	Thoracic deformity Jutting sternum	—	—	—
Wide ribs	Thin ribs	—	—	—
Deformed joints	Thin ribs	Do.	—	Increased laxity of ligaments
Limitation of movement	Flaccid joints	—	—	
Thickened diaphyses	Thinned diaphyses	Extremities thick, squat	Short extremties	Short extremities
Coxa valga; genu valgum	Coxa vara	—	—	—
—	Destructive bone lesions	—	—	—
Ossification perhaps retarded	Destructive bone lesions		—	—
Corneal opacities	Normal cornea	Normal	Normal	Frenum over eyes
Smooth thick skin	—	Edematous skin rough	—	—
Distended abdomen; umbil. hernia	Less distended	—	Normal	Weak abdomen; umbil. hernia
Hepatosplenomegaly	—	—	—	—
Hypertrichosis	—	Hypotrichosis	—	—
Deafness	Normal hearing	Hypotrichosis	Do.	Do.
Psychomotor development retarded	Normal hearing	—	—	Marked functional insufficiency
Backward psyche	Normal	Arrested	Normal	Arrested
—	Hypotonus	Hypotonus hypogenitalism	Normal	Congenital anomaly
—	—	Hypercholesteremia constipation Basal metabolism	—	—

The forms of Hurler's disease without corneal opacification, are hereditary and are sex-bound as is hemophilia. This explains why female patients always show corneal opacities. It is unlikely, however, that the mutation of a single gene will explain so complex a syndrome.—*M. L. Sussman, M.D.*

VON NIDA, S. Zur Differentialdiagnose des sog. Corticalisosteoids. (The differential diagnosis of the so-called cortical osteoid). *Chirurg*, April, 1950, *21*, 247–249.

Two cases are presented to support the view that the cortical osteoid is due to a reactive process which originated long before roentgenographic evidence is elicited. The first patient had an injection in her thigh four years prior to the discovery of a femoral lesion. The other patient had pain in the thigh over a thirteen year period, but recalled no

trauma or local infection. The roentgenographic findings remained stationary for one and a half years. There was no evidence of inflammatory reaction or sequestration.

The author does not completely justify the title, since no attempt is made at a differential diagnosis. —*J. Zausner, M.D.*

Genscher, W. Die primäre Osteomyelitis purulenta acuta der Wirbelsäule. (Primary acute purulent osteomyelitis of the spine.) *Chirurg*, April, 1950, *21*, 240–247.

Citing the hitherto high mortality in acute pyogenic osteomyelitis, the author presents 3 cases successfully treated with sulfonamides and penicillin. The diagnosis is made on a history of antecedent furuncle, abscess or other pyogenic infection; a short interval between pain and roentgenographic evidence of bone changes; point tenderness; limitation of movement, especially on flexion; and a toxic patient. The condition is differentiated from tuberculosis by mild compression of the intervertebral disc; a bone regeneration greater than bone destruction; healing associated with bony spurs or bridging; characteristic bacteriological findings.

Early surgical intervention is avoided except for application of a cast. However, drainage, sequestrectomy, and rarely laminectomy are performed when indicated. Conservative therapy is less effective, of course, if the abscess is walled off.—*J. Zausner, M.D.*

Oelbaum, M. H. Medical aspects of carcinoma of the prostate with secondary deposits in bone. *Lancet*, April 29, 1950, *1*, 811–813.

The discovery that estrogens can be used efficiently in the treatment of prostatic carcinoma has made early and correct diagnosis of great importance. Carcinoma of the prostate may be indistinguishable clinically from simple hypertrophy, even though it may already have given rise to metastases. It is therefore very fortunate that a biochemical test—the estimation of acid phosphatase in the serum—has proved of such value in diagnosis, especially when there are osseous metastases.

A notable advance was made by Herbert (1944, 1945) when she demonstrated that prostatic acid phosphatase in serum is destroyed by alcohol but that acid phosphatase in normal serum (produced by extraprostatic tissues) is alcohol-stable. Thus the moderate increase in serum acid phosphatase sometimes found in Paget's disease is alcohol-stable, whereas in metastasizing prostatic carcinoma, with raised serum acid phosphatase, treatment of the serum with alcohol lowers the titer usually to normal. Occasionally even when the total serum acid phosphatase titer is not raised, a significant amount of prostatic phosphatase in the serum may enable a diagnosis of prostatic carcinoma to be made.

A study was also made of the effect of stilbestrol on the serum acid and alkaline phosphatase of 6 patients with Paget's disease. The acid phosphatase was not affected, and the alkaline phosphatase either remained stationary or slowly fell. Thus examination of the effect of estrogens on the serum acid and alkaline phosphatase may help in deciding between Paget's disease and secondary prostatic metastases; moreover, as already noted, the rapid disappearance of pain in the latter and not the former will soon decide the issue.

Attention has again been directed to the similarity in the roentgen appearances of the pelvis of Paget's disease and osteoblastic metastases. Differences in the behavior of the acid phosphatase in these two conditions are described.—*E. J. McDonald, M.D.*

Cocchi, Umberto. Sippentafel bei Marmorknochenerkrankung mit dominantem polyphänem Erbgang. (Genetic chart in marble bone disease with dominant polyphan heredity.) *Fortschr. a. d. Geb. Röntgenstrahlen ver. m. Röntgenpraxis*, May, 1950, *73*, 77–86.

Schinz, in 1944, by enlarging the classification of Harnapp, proposed that on genetic basis the following four types of marble bone disease be distinguished.

I. Simple-dominant monophan heredity type with a mild course characterized exclusively by osteosclerosis with good prognosis.

II. Simple-dominant polyphan heredity type with initial benign course and subsequent change into severe anemia with strong intrafamilial variability.

III. Simple-recessive polyphan heredity type with lethal outcome, early malignant course and bad prognosis.

IV. Simple-recessive monophan heredity type with mild course and relatively good prognosis.

Marble bone disease thus can exhibit a monophan trait when a single characteristic (typical generalized sclerosis of the entire osseous system) is present or a polyphan trait when several characteristics (generalized osteosclerosis associated with optic atrophy, deafness, anemia) occur together. The blood alterations often are completely independent of the pathologic or roentgenologic changes of the bone.

The author deals in particular with Type II of marble bone disease. In so doing he presents the genealogic chart of a family of five generations comprising 91 individuals, 3 of whom had marble bone disease showing dominant monophan heredity with strong intrafamilial variability. This is the third genealogic chart of such heredity (Type II) recorded in the world medical literature. Part of it was published twenty-three years ago by Lauterburg and, on the basis of the data available at that time, it was concluded that the family had marble bone disease of the simple-recessive type. This conclusion was generally accepted in the literature. The

author, after examining subsequent generations, now finds that the heredity in fact is of the simple-dominant type.

The opinion is expressed that as a result of later studies similar observations may be made in other instances of marble bone disease presently described in the literature as being of the simple-recessive type.—*L. A. Nash, M.D.*

BÖHLER, JÖRG. Zur Pneumoradiographie des Kniegelenkes. (Pneumoroentgenography of the knee joint.) *Neue med. Welt*, May 27, 1950, *1*, 742–743.

Böhler describes a method of pneumoroentgenography of the knee joint using a suprapatellar needle puncture entering the retropatellar space after novocaine infiltration of the site, injecting 60 to 100 cc. of air with a syringe. The space is then compressed to force the air into the knee joint. The patient is hospitalized for forty-eight hours during which time the air is absorbed. No infection or effusion has resulted from this method.

Roentgenograms are made in the anteroposterior and lateral positions with the patient supine but with the suspected side of the knee upward so that the joint fluid gravitates away from the involved side. Additional films are taken in four tangential views, projected in the horizontal plane of the tibial surface circumferentially through four quadrants of the suspected meniscus with the knee slightly flexed and elevated on a wood block, the patient remaining supine. The leg is abducted for roentgenography of the medial meniscus and adducted for the lateral meniscus study. Compression is applied to the puncture site after the procedure by means of an elastic bandage.

Nine reproductions of roentgenograms, seven sketches and a single photograph are shown. Air between the tibia and menisci is considered a normal finding. During the years 1936 to 1945, contrast studies of the knee were made 205 times at the author's hospital. Of 21 cases analyzed in this paper, 15 had positive roentgen evidence of meniscus tears and were proved by operation with a questionable roentgen diagnosis of tear later shown to be normal. A false positive case shown later to be a cartilaginous rest near the midline was interpreted as a meniscus tear. The method appears to be quite simple as compared to previous techniques. The use of the multiple tangential views is stressed.—*L. A. Nash, M.D.*

SOMERVILLE-LARGE, C. Strains of the ankle joint. *Irish J. M. Sc.*, May, 1950, *6*, 225–228.

The commonest injury to the ankle joint, the inverse twist with the foot in plantar flexion, is discussed.

The upper articular surface of the talus is about one-quarter inch wider in front than behind; consequently, in dorsiflexion of the foot the wider part of the talus is engaged in the tibiofibular mortice, and in plantar flexion the narrow portion. Considerable variation in opinion exists as to how the tibia and fibula adjust themselves to this variation in the talus. Either the tibiofibular joint widens with stretching of the thick interosseus ligament, or the fibula is rotated outwards with consequent inward bending of the middle third of the fibula. The author believes that ligaments do not normally lengthen or shorten and consequently thinks that the fibula rotates slightly in ankle joint movement.

If rotation does occur at the tibiofibular joint, a test now used to differentiate between a sprain and a dislocation at the ankle joint cannot be relied upon. In this text roentgenograms are made of the ankle joint from in front with forced inversion of the foot. If no tilting can be seen, it is considered a simple sprain; if tilting is seen, it is considered to be a complete avulsion.

The author then describes the ligaments about the ankle joint and believes that in most inverse strains, no ligaments are torn but instead the capsule about the joint may be torn.

He concludes that in normal ankle joints there is some tilting of the talus on forced inversion with the foot in plantar flexion. In support of this, he made roentgenographic examinations in 21 normal ankle joints; 67 per cent of these showed obvious tilting of the talus.—*W. M. Roy, M.D.*

MENNENGA, MENNO. Die Entstehung der lokalen Knochennekrosen. (The genesis of local bone necroses.) *Chirurg*, Feb., 1950, *21*, 71–73.

Local bone necrosis constitutes the essential finding in certain clinically, roentgenologically and morphologically well defined entities such as Perthes' disease, Köhler's disease I and II, Kienböck's disease, necrosis of the sesamoid bones and less frequently necrosis of other spongy bones.

All these entities have several features in common. They appear in adolescence, except Kienböck's disease, which has the peak of its occurrence between the ages of twenty and thirty years; they affect short spongy bones or demarcated portions at the ends of pipe bones and they have a predilection for the bones which are situated at pivotal points in the lines of greatest force.

There is also a similarity in their clinical course and roentgenological appearance. Following an insidious onset the patient develops indefinite complaints and occasionally, when the bone is close to the surface, there is an edema of the soft tissues. The first roentgen signs become manifest after a longer period and consist of irregular areas of increased translucency intermingled with thickened trabeculations or occasionally with small cysts. In the later stages deformity of the affected bone de-

velops followed by secondary changes in the neighboring joints.

The author was able to make histopathologic studies in 10 cases including most of the above-enumerated entities. The morphologic findings were quite uniform. In all cases there was evidence of areas of aseptic bone necrosis of various size. In a few, small foci of necrosis were also present in the marrow, which otherwise was intact or replaced by a fibrillar network. New bone formation was noted only occasionally.

The plausible causative factors are divided into four categories: (1) single forceful trauma, but without producing fracture; (2) protracted trauma, consisting of small repeated injuries none of which leaves a demonstrable effect; (3) insidious onset without given cause, and (4) infectious diseases or process. After analyzing the significance of each of these factors, the author expresses the opinion that the etiology of local bone necrosis for the time being must remain unsolved.

An investigation of the pathogenesis leads to more tangible results. In a series of formerly published experiments the author obtained extensive necrosis of the marrow and adjacent layers of the compact bone by injecting small amounts of various fluids (physiologic saline solution, foreign serum and autoblood) into the femora of rats. This proves that fluids which ordinarily are tolerated by the organism without undue reaction can bring about the necrosis, most probably through the displacement of the marrow and disturbance of the blood supply. In additional experiments the author injected into the femora of rabbits foreign serum in such small amounts that no displacement of the marrow resulted. After repeated injections a hyperergic inflammation developed followed by changes (marked stasis, necrosis, and fibrous transformation of the marrow; extensive necrosis of the bone) which were similar to those observed in the local bone necrosis of the above-enumerated entities.

On the basis of these observations, the author attributes the genesis of local bone necrosis to the disturbed capillary blood circulation resulting from various aseptic processes among which the allergic processes occurring within the bone marrow predominate. Owing to the great sensitivity of the bone to any disturbance of its blood supply, such processes could be of only short duration. The subsequent events then are determined by the induced secondary changes, whereas the underlying primary cause may have long since disappeared.—*T. Leucutia., M.D.*

Greenfield, Maurice M., and Wallace, K. M. Pigmented villonodular synovitis. *Radiology*, March, 1950, *54*, 350–356.

The authors review the literature and nomenclature of villonodular synovitis and its related variants. The gross and microscopic findings in the various phases of the disease are noted.

The disease most frequently involves only one joint in young adults. The diagnosis is suspected chiefly by the clinical findings of marked swelling, palpable nodules and impaired function. The roentgenograms are contributory only in a negative sense. Best treatment is roentgen therapy. Most patients received 1,500 r in air or more high voltage roentgen therapy to each of two areas.—*E. E. Seedorf, M.D.*

Haas, S. L. Restriction of bone growth by pins through the epiphyseal cartilaginous plate. *J. Bone & Joint Surg.*, April, 1950, *32A*, 338–343.

In this study, a series of thirty experiments were performed mostly on rabbits, in which pins or nails, were passed through the epiphyseal cartilaginous plate. Another, more recent series of experiments were performed on dogs, in most of which sufficient time has not elapsed to give the final results. It was found that pins or nails passed diagonally across the epiphyseal cartilaginous plate prevent growth in length from that end of the bone. Such pins fix the epiphysis to the diaphysis and prevent the progression necessary for length growth. In check experiments in which the pins were removed immediately after insertion, no loss of growth resulted. This finding ruled out the possibility that the loss of growth was due to primary injury to cartilage cells.

Haas believes the question regarding the activity of cartilage cells after removal of the restricting device, wire loops, staples, crossed pins or nails, has not been answered completely. In most of the experiments, there was evidence that the growth property of the plate was not so active as normal, and in some instances there was almost complete loss. In removing any of the devices, there was additional destruction of the circulation to the plate, damage to the plate itself, and the possibility of producing a bridge across the plate. It is believed by Haas that a method which produces less injury at the time of removal will improve the results. He also believes it is advisable to place markers in both the normal bone and that which has been operated upon, so as to have a record of the growth from each epiphyseal plate. In some of his experiments there was evidence of compensatory growth from the non-restricted plate at the opposite end of the bone. He recommends that careful teleroentgenograms or scanograms be taken to obtain exact growth indices and to rule out the possibility of inaccurate measurements.

Unilateral retardation of growth was produced when two pins were inserted so as to cause fixation of only half of the plate. Some restriction was noticed on the opposite side as well, causing shortening of the entire bone. There was also the possibility of permanently damaging that side of the plate when removing the restraining device. If permanent injury

has been produced, a deformity in the opposite direction may take place.

Pins or nails passed immediately above the epiphyseal plate caused some loss of length growth. The mechanism of this restriction, Haas thinks, may depend upon fixing of the periosteum, which secondarily may hinder, to some extent, the advancement of the epiphysis away from the metaphysis.

The experiments in which pins or nails were passed longitudinally through the epiphyseal plate produced a rather surprising amount of growth restriction in some cases. The growth retardation was most marked when the pins approached the articular cartilage.—*R. S. Bromer, M.D.*

Hess, Wallace E., and Street, Dana M. Melorheostosis; relief of pain by sympathectomy. *J. Bone & Joint Surg.*, April, 1950, *32A*, 422–427.

Melorheostosis is a rare condition, characterized by hyperostosis of certain bones or parts of bones. The distinguishing features are: (1) restriction of the involvement to the bones of one limb; (2) distortion of the outline of the affected bone by the flowing hyperostosis; (3) pain, occasionally severe, but usually dull and aching in character; and (4) stiffness and limitation of motion in the joints of the involved limb. Pain, the most frequent symptom, occurs in half of the cases, particularly in the older patient. It is usually dull and aching in character but is seldom severe.

In the case reported in this paper, the lesions were confined to the right upper extremity. The clinical course with gradual progression and increasing pain was also typical. Treatment by thoracic sympathectomy gave dramatic relief from symptoms. As far as the authors can determine from the literature, this is the first form of treatment which has been of lasting value in this rare and painful condition.

Thoracic sympathectomy was performed on the patient, a man, for three reasons: (1) some degree of relief had been obtained from stellate-ganglion blocks and thoracic sympathetic blocks; (2) anodynes, physical therapy, etc., had already beeen tried unsuccessfully; (3) the patient was unable to concentrate on any type of work because of pain, and therefore requested that the operation be performed.

The patient had a macrotia on the right side. The ear was dusky red in color and warmer to palpation than the left. It measured 3 inches in length, as compared with 2¾ inches for the left. The significance of this accompanying macrotia on the right is not known. Associated anomalies have been reported to support the theory of a congenital origin of melorheostosis.—*R. S. Bromer, M.D.*

Steel, Howard Haldeman. Calcified islands in medullary bone. *J. Bone & Joint Surg.*, April, 1950, *32A*, 405–412.

This paper comments on the asymptomatic, unilateral, irregular, radiopaque, insular lesions found in routine roentgenographic studies and usually classified by roentgenologists as calcified medullary defects of no pathological significance. These defects are observed most commonly in the ends of the long bones, situated centrally in cancellous material. Bone trabeculae are not observed to pass through these islands. Their usual shape is oval although many consist of amorphous, irregularly demarcated areas of calcification. Their density is homogeneous and they do not appear to be delimited by a capsule. Their size varies from 0.5 to 7.5 cm. in diameter. The cortical bone is not deformed and there is no evidence of expansile tendencies.

The location of 120 of these defects is illustrated in the table in the article, the largest number occurring in the femoral neck. All of the patients were males. In none of the cases was there a history of submarine duty, deep-sea diving or caisson disease.

No satisfactory explanation as to the origin of the calcified medullary defects can be given. Developmental factors may be involved, with faulty ossification of cartilage as the end result. Nutritional factors, such as scurvy and rickets, have been suggested, but a causal relationship has not been substantiated. The location around joints suggests trauma as an etiological factor, as do the unilateral location and the single lesion. Twenty-four per cent of the defects were found in patients exhibiting some form of the arthritides. Twenty-seven per cent occurred in patients in whom blood-vessel abnormalities were the foremost finding. However, the significance of this fact is difficult to evaluate.

The differential diagnosis from osteopoikilosis, osteoid osteoma, osteogenic sarcoma, metastatic lesions, chondrodysplasia, bone infarct and caisson disease is discussed and 2 cases are reported with reproduction of the roentgen findings and histological sections.—*R. S. Bromer, M.D.*

Townley, Charles O. The capsular mechanism in recurrent dislocation of the shoulder. *J. Bone & Joint Surg.*, April, 1950, *32A*, 370–380.

This paper is based on a study of 58 patients with recurrent dislocation of the shoulder. In it the mechanics of dislocation, the pathological findings, the defect on the humeral head, the glenoidal labrum, the capsule of the joint, operative technique and evaluation of results are discussed in detail.

Functional lengthening of the capsule and loss of the anterior restraining effect of the capsular mechanism appear to be the primary causes of recurrent dislocation of the shoulder. Separation of the medial attachment of the capsule from the anterior glenoid margin is the most consistent cause of capsular lengthening. Congenital lengthening is probably present more often than is suspected, but interpretation

is made difficult by the finding of secondary damage at the glenoid margin. The function of the normal capsule, which allows this usually lax structure to become an effective barrier against anterior projection of the humeral head in external rotation, is referred to as the capsular mechanism.

A roentgenogram in the axillary or vertical projection, with the arm in approximately 30 degrees of external rotation, shows the proximity of the area of defect in the humeral head to the anterior glenoid margin when functional lengthening of the anterior portion of the capsule is present. Townley found that this position of external rotation was slightly less than that necessary to produce dislocation. Slightly more external rotation caused the shoulder to become redislocated three times before this view was obtained. At operation, complete detachment of the anterior portion of the capsule from the scapular neck was demonstrated.

Repair, Townley states, should aim at reestablishment of the capsular mechanism. If there is no medial capsular separation, a modification of Magnuson's procedure is adequate. If there is separation of the capsule, but capsular tissue remains at the glenoid margin, sutures into the soft tissue only need be used. If there is complete loss of soft tissue from the anterior glenoid margin, the capsule should be anchored directly to the bone. Re-attachment of the glenoidal labrum is not necessary, and the presence or absence of this structure does not alter the operative procedure or the success of the repair. Limitation of shoulder motion to prevent dislocation is usually not necessary.—*R. S. Bromer, M.D.*

Adams, J. Crawford. The humeral head defect in recurrent anterior dislocation of the shoulder. *Brit. J. Radiol.*, March, 1950, *23*, 151–156.

Recent investigations have settled a controversy which has been the subject of long discussion. It has been determined that there are two important factors in the development of recurrent anterior dislocation: one is stripping of the capsule from the anterior aspect of the glenoid and neck of the scapula; the other is a characteristic defect in the articular surface of the humeral head. The relationship between the bone defect and the tendency to redislocation was recognized more than one hundred years ago, but the importance of the osseous defect has not been sufficiently emphasized.

The characteristic defect is a clearly defined depression or flattened area on the posterolateral aspect of the upper portion of the articular surface of the humeral head. It may be only a shallow groove, or it may be as much as a third of the entire surface. This defect arises because of the trauma at the time of the first dislocation and represents a compression fracture of the head. Subsequent dislocations occur when the arm is abducted, externally rotated, and extended backward, permitting the humeral head at the site of the defect, to slip over the glenoid labrum.

The bone defect is obscured by overlying bone in most routine roentgenograms, and can be satisfactorily seen only in profile. It is shown well in anteroposterior views with the arm internally rotated 60 to 70 degrees. The large defects are obvious, but smaller defects are sometimes difficult to identify. Comparison with a normal humerus in a comparable view helps. In a small defect the normal convex outline of the articular surface near the shadow of the greater tuberosity is replaced by a straight or concave line; and a line of increased density is shown extending distally parallel to the long axis of the shaft beginning at the top of the humeral head.—*E. F. Lang, M.D.*

Seidenstein, Harold. Acute pain in the wrist and hand associated with calcific deposits; report of fifteen cases. *J. Bone & Joint Surg.*, April, 1950, *32A*, 413–418.

Roentgenographically demonstrable calcific deposits have been found in many regions of the body, most commonly about the shoulder joint, frequently in and around the elbow, hip and knee, but rarely at the wrist and palm. In this paper, 15 cases are analyzed. They fall into three groups: (1) those cases with deposits along the course of the flexor carpi ulnaris at and about the pisiform bone; (2) those along the course of the flexor carpi radialis at or about the greater multangular bone; (3) those in the palmar aspect of the hand at one of the metacarpal heads.

The clinical picture was usually dramatic and acute, particularly in those cases with deposits at the wrist. All of the patients complained of severe pain in the region of the wrist of sudden onset and short duration. There was associated swelling of the wrist, sometimes localized to the region of the deposit, but often including the entire dorsum of the wrist and hand. The tissues of the involved area were indurated and exquisitely sensitive. Roentgenograms of the involved area showed the shadow of a calcific deposit in the soft parts. The appearance of the calcification was often that of an area of homogeneous opacity, about 3 or 4 mm. in diameter and rounded in shape but this was not always constant. Some of the deposits were extremely large and dense, measuring 1 to 2 cm. in the roentgenogram, whereas a few of them were only slightly larger than a pinhead and might well be overlooked if the condition were not suspected. Subsequent roentgenograms showed the disappearance of the small opaque areas which indicated their clinical significance. In some cases, the opaque areas were long, linear and fragmented. The severity of the clinical picture was usually related to the size of the deposit. None of the deposits were explored surgically. The precise location of the deposits is speculative but it seems probable that they lay within the peritendinous soft tissues, that is tendon

sheaths, bursae, or ligaments. Any form of treatment that offers symptomatic relief is indicated as the condition is apparently self-limited and recovery is spontaneous. Immobilization by plaster bandage gives immediate relief of pain in most cases.—*R. S. Bromer, M.D.*

PETERSON, LEONARD T. Dislocation of the hip associated with fracture of the neck of the femur. *J. Bone & Joint Surg.*, April, 1950, *32A*, 274–279.

Two cases of the unusual combined injury of fracture of the femoral neck and dislocation of the hip are reported in this paper. Peterson believes that primary operative treatment is indicated in this injury as it is improbable that a reduction can ever be accomplished by manipulation alone, since the femoral head in such injury cannot be controlled through the shaft. The difficulties encountered at operation indicate that closed manipulation is futile. There are two alternative primary operative procedures to which the surgeon may resort in treatment: (1) reduction which may be attempted when the femoral head is intact, (2) removal of the head, followed by a reconstruction operation. One personal case was followed by the author for a period of seven years after operative reduction and primary fixation by a bone graft. After nearly five years of unlimited activity, necrosis and severe arthritis developed. The author believes that primary removal of the femoral head, followed by a reconstruction operation is justified.—*R. S. Bromer. M.D.*

PIPKIN, GARRETT. Lesions of the suprapatellar plica. *J. Bone & Joint Surg.*, April, 1950, *32A*, 363–369.

Disturbances of the suprapatellar portion of the synovial cavity of the knee joint have been described vaguely in surgical writings as "adhesions." In 78 per cent of adult knees, a suprapatellar plica exists, representing the fusion of the suprapatellar bursa with the knee joint. The synovial stratum upon the surface of the infrapatellar fat pad forms a band which extends from the patella to the intercondylar notch, called the plica synovialis patellaris. At its femoral end it is narrow and attenuated, but at its patellar end it expands on each side to form wing-like fringes. Apart from these special foldings, the synovial stratum lines the deep surface of the common extensor tendon and extends for a variable distance proximal to the patella. This extension of the articular cavity communicates with a large bursa situated still more proximally on the front of the femur.

Pneumoarthrography has provided a practical method of demonstrating the variations in the suprapatellar space. Some of the variations encountered are (1) an open communication with no evidence of a plica remaining between the suprapatellar bursa and the knee joint; (2) a moderate plica; (3) a distinct separating membrane, but with a communication; and (4) no communication. In the last instance the suprapatellar space appears abnormally small, because the portion ordinarily contributed to it by the bursa is not visualized. In the pneumoarthrograms the density of the suprapatellar plica serves as an index of synovial reaction and is a value in prognosis.

Fibrosis, hyalinization or calcification of the suprapatellar plica mechanically interferes with the extensor apparatus, producing a syndrome of pseudo "locking" pain, and chronic effusion, which is to be differentiated from other intra-articular disabilities. —*R. S. Bromer, M.D.*

ERICKSON, PAUL T., and MAYORAL, A. An unusual lesion of the talus occurring in leprosy. *Radiology*, March, 1950, *54*, 357–364.

This is a report of two lepers who had a destructive lesion of the talus thought to be due to involvement of the bone by *M. leprae* rather than destruction secondary to neurotrophic changes.

Intermittent pain and swelling of the ankle was present in both patients and the roentgenograms showed a small moth-eaten area of destruction in the inferior portion of the neck of the talus. In 1 patient the lesion promptly healed and in the other the destruction continued, and healing took place only after adjacent bones were involved with a resulting splayfoot.

Involvement of the tarsal bones in lepers is common when there is a marked neurotrophic process present or when overlying cutaneous infection involves the bone by direct extension. These 2 patients did not have either of these conditions and therefore the authors believe the talus was involved by *M. leprae* via the blood stream from leprous lesions elsewhere in the body.—*C. A. Stevenson, M.D.*

HARK, F. W. Rocker-foot due to congenital subluxation of the talus. *J. Bone & Joint Surg.*, April, 1950, *32A*, 344–350.

Rocker-foot has been defined by McMurray as a condition in which the sole of the foot is convex because the heel is in equinus; the forepart is in a variable amount of extension and valgus, so that the most prominent part of the sole is formed by the head of the talus. He called it congenital flat-foot. In the American literature, the term congenital flat-foot is applied to a mild depression of the longitudinal arch, which is thought to have existed since birth.

The pathological changes associated with this deformity are best appreciated from study of roentgenograms. The talus points downward into the sole of the foot, its long axis being nearly a continuation (175 degrees) of that of the tibia. The calcaneus is carried into equinus with the talus. This deformity

causes a break in the alignment of the tarsal bones at the midtarsal joint, so that the navicular does not articulate with the head of the talus, but faces the dorsal surface of its neck. The cuboid lies somewhat above the calcaneus, the plantar half of its posterior end being atrophied and compressed because of pressure stresses. The general appearance is not unlike a rocker; hence the term "rocker-foot" is frequently seen.

Between 1932 and 1941, 12 patients (18 cases of rocker-foot) were seen by the author. This condition should be diagnosed as early as possible, as its treatment is difficult in an older individual. It is not until adult life that symptoms develop. None of the patients in his group presented themselves because of symptoms. They were either sent by a nurse or because the family was concerned about the appearance of the feet.

Etiologically there were two points of interest in his series. The first was the multiplicity of deformities found in the patients and the second was the occurrence of but one case of spina bifida. The author believes that spina bifida is only one manifestation of a developmental disturbance which may include rocker-foot as well as other deformities. It may result from improper treatment of club-foot. The condition is best controlled by surgical procedures.—*R. S. Bromer, M.D.*

Herschel, H., and von Ronnen, J. R. The occurrence of calcaneonavicular synosteosis in pes valgus contractus. *J. Bone & Joint Surg.*, April, 1950, *32A*, 280–282.

A study of the literature gives the impression that calcaneonavicular synosteosis is a rare affection. In the authors' experience, calcaneonavicular synosteosis in combination with pes valgus contractus occurs more frequently than is generally assumed. Slomann distinguished three forms of synosteosis: (1) the complete bony bridge, (2) the fibrous cord or syndesmosis in which one or more osseous bodies are often found embedded in the fibrous tissue, (3) the amphiarthrosis, a kind of stiff joint between abnormally well developed protuberances of the calcaneus and the navicular. It is impossible to demonstrate syndesmosis or amphiarthrosis directly with roentgen rays, but if osseous bodies are found, together with the clinical phenomenon of pes valgus contractus, the authors believe that the diagnosis of calcaneonavicular syndesmosis is justified. The amphiarthroses may be identified by the finding of abnormally well developed protuberances on the sides of the calcaneus and the navicular which are facing each other, particularly if the ends of the protuberances resemble joint facets.

In all cases of spastic flat-foot combined with calcaneonavicular synosteosis it is advisable to take roentgenograms in three planes, namely (a) dorsoplantar, (b) mediolateral and (c) at an angle of 45 degrees (method of Chaumet and Ferry).—*R. S. Bromer, M.D.*

Baker, S. L., Golding, F. Campbell, Crooke, A. L., and Blomfield, G. W. Metastatic tumours of bone. *J. Faculty of Radiologists*, April, 1950, *1*, 245–266.

Pathological Aspects. The reactions of the surrounding bone to a bone tumor, according to Baker, are dependent on its rate of growth and other factors. The bone architecture may be unaffected by a tumor, particularly in early stages. The effect may be predominantly bone absorption but except with very rapid absorption there is usually some osseous reconstruction rather than a complete loss of bone architecture. Tumor cells cannot themselves absorb bone —they act by stimulating osteoclasis. The effect of a tumor may be chiefly bone deposition, commonly produced as a reaction to both primary and secondary tumors of bone. Various types of tumor differing widely in histopathological structure may occasionally produce such osteoplastic metastases, as, for example, bone production by a secondary carcinoma of intestinal origin. There may be difficulty in distinguishing primary from secondary tumors, even when clinical, roentgenographic and pathological features are carefully assessed. This is particularly the case in Ewing's sarcoma. The osteoplastic reactions to tumors are very similar to the reactions to inflammatory stimuli. A more rapid reaction produces a fine network of woven bone in periosteal and/or endosteal tissue. With a slower type of reaction lamellar bone is formed either on the surface of existing lamellar bone (sclerosis) or on a basis of woven bone trabeculae.

Diagnostic Aspects. There is a difference in the reported incidence of bone metastases, depending upon whether the observer is a radiologist, a clinician reporting terminal events in hospitals for chronic diseases or a pathologist reporting on necropsy material. This report by Golding is based on the evidence of metastases seen by a radiologist in an average hospital.

The majority of metastases in bone are osteolytic. This type often causes great suffering, and death follows after a variable but short period. The osteoplastic lesion grows slowly and may cause relatively few symptoms. The osteoplastic component of mixed deposits is not appreciated fully. The author's figures showed the mixed lesions in a fifth of cases of carcinoma of the breast. There is no primary tumor from which the metastases are invariably either osteoplastic or osteolytic. The malignant cortical tumors of the kidney probably give the highest proportion of the latter.

Metastases are most often found in bones containing a large proportion of red marrow, particularly near the entry of nutrient foramina or the insertion of fibrous and ligamentous structures. Batson dem-

onstrated that the spread of carcinoma of the prostate may be attributed to the plexus of vertebral veins. The order of incidence in various bones is: pelvis, lumbar spine, femur, ribs, shoulder girdle, but this is almost the same order as for metastases from carcinoma of the breast. Metastases from the breast are found in the skull and upper limbs but these are extremely rare sites for deposits from cancer of the prostate. Among Golding's breast cases there was a higher percentage for deposits in bone than in lungs but in general metastases to lungs are more frequent than to bone. It is not an uncommon experience to find one or more secondary deposits in bone without any primary growth being revealed after careful search. The most important factor in the diagnosis of metastases is experience. This enables a radiologist to say that a lesion looks like or does not look like a secondary deposit but he may have difficulty in giving his reasons. It may be impossible to identify the nature of a few of the metastatic lesions of bone. A few metastases resemble primary tumors, particularly those in bone from primary osteogenic tumors. Part of the difficulty in diagnosis is due to the great variation in the structure of primary tumors and the capacity of the bone to react in many different forms. The occasional solitary metastasis may cause an error in diagnosis if no primary lesion is known. It often exhibits all the features which make a diagnosis difficult, including expansion, coarse trabeculation, or spiculation. It may be said of all primary tumors that those which rarely metastasize to bone often cast solitary deposits and the uncommon deposit tends to be unusual in appearance. The list of conditions which resemble metastases is formidable. Myelomatosis is the most common condition which causes difficulty. It can be divided into three types: (1) the solitary lesion which resembles an osteoblastoma; (2) the multiple lesions which either exhibit a pattern in the medulla or which, alternatively, appear to be imperfectly encapsulated; (3) the generalized form which bears the closest resemblance to carcinomatosis. Two useful features in the diagnosis of a carcinomatosis are the osteoporosis which affects the bone between the deposits and the presence of one lesion which causes slight expansion, the others being entirely destructive, a common location being in a rib.

Endocrine Aspects: Relationship of the Steroid Hormones to Cancer. According to Crooke, one of the first attempts to control breast cancer by altering the hormone balance was made by Sir Hugh Lett at the London hospital in 1905. In a group of 99 breast cancer patients treated by bilateral oophorectomy he reported clinical improvement in 41.3 per cent of the patients who were fifty years of age or less, but only 23.2 per cent of the whole group. In 1932 Lacassagne first produced breast cancer in mice treated with estrogens. Since then much work has been done on the experimental production and inhibition of cancer by hormones, but we are still in the dark about the fundamental mechanism of hormone control. The known hormones influence experimental breast cancer in the following manner: estrogens will produce a high incidence of breast cancer in a cancer-resistant strain of mice and testosterone will inhibit it in a cancer-prone strain. The hormones of the ovary, testis and adrenal cortex are closely related chemically, having the same basic nucleus, the steroid nucleus. It would not be surprising, therefore, to find that the adrenal cortical hormones also have some influence on cancer. In Cushing's syndrome in the human there is a propensity to tumor formation. Cushing's syndrome is believed to be due to an excessive production of the adrenal cortical S-hormone of Fuller Albright, like Kimball's compound E which has come to the fore in the treatment of rheumatism. One wonders if there will be an increased incidence of cancer in patients treated with it. Most evidence suggests that the action of the steroid hormones on tumors is not a specific action but is associated with their normal physiological function.

Women who develop breast cancer in their later years have a delayed menopause, at the age of fifty or older, five times as often as those who do not develop such cancers. This indicates a prolonged though not necessarily increased estrogen production. The conclusive evidence that human cancer is influenced by various hormones is to be found in the results of treatment of certain tumors with androgens or estrogens. Adair claimed a remarkable degree of improvement in patients with breast cancer treated with testosterone. Most cases relapse after eight months or more. Stilbestrol alone, usually in doses of 15 mg. daily, was found to be effective mainly in the post-menopausal groups. The evidence seems to suggest that the hormones influence cancer indirectly through their ordinary physiological function.

Radiotherapeutic Aspects. Blomfield reports a series of 30 patients referred for radiotherapy with a diagnosis of "secondary bone tumor—primary unknown," 22 of whom received deep roentgen therapy, with an average survival period of 5.27 months after beginning treatment. Approximately one-third of these 22 received symptomatic relief. In another series of 32 bone metastases from known carcinoma of the breast the average survival time was ten months, with 56 per cent partial or marked relief of symptoms. Sherman and Pearson in 1948 reported on a series of 36 metastatic tumors of bone from renal carcinoma, with pain the outstanding feature in 32 patients. They concluded that roentgen therapy exerted little, if any, effect on the growth or lesion.

In carcinoma of the cervix and body of the uterus, bone metastases are comparatively rare. The tendency is for such cancers to invade bones locally by direct spread from the parametrium or from involved lymph nodes near the common iliac glands, rather than by blood stream emboli. Blomfield reports an incidence of 1.33 per cent of secondary bone tumors from carcinoma of the cervix and uterus in a period

of four years in about 600 patients seen at the Sheffield Radiotherapy Centre.

Carcinoma of the breast is notorious for its propensity to form bone metastases. The bone marrow can be readily permeated by the tumor growth, making it unlikely that a disease which spreads so profusely along the shafts of the bones can be cured. Occasionally considerable pain relief occurs without much roentgen, evidence of resolution. Spine metastases are almost always worth treating because of pain relief which ensues.

Patients with carcinoma of the esophagus rarely survive long enough for secondaries to manifest themselves. This spread may occur by way of the vertebral veins and venous channels to the body of the vertebra immediately behind the lesion.

There may be a more hopeful outlook in secondary growth from carcinoma of the thyroid than in other types of bone metastases. Two cases are cited, in one of which deep roentgen therapy gave considerable relief of symptoms and some evidence of control, with healing of a pathological fracture of the femur. Another patient has been under treatment with I^{131}. Three separate doses were given orally at two month intervals, 38.3 mc., 155 mc., and 117 mc., respectively. The second and third doses were followed by clinical improvement. Primary bone formed as a shell around the tumor where a pathological fracture of the femur had occurred. However, this amount of I^{131} was as much as could be given safely without causing very severe blood changes.

Blomfield concludes that careful selection of patients is necessary for good results and that supervoltage roentgen therapy would be advantageous. Radiation therapy of generalized bone metastases is seldom of any use except for pain relief, but radioactive iodine is probably valuable for the functioning metastatic lesions of thyroid adenocarcinoma.—*S. G. Henderson, M.D.*

Prevo, Samuel Bradley. A clinical analysis of 205 cases of malignant bone tumor. *J. Bone & Joint Surg.*, April, 1950, *32A*, 298–306.

This study was suggested to the author after a review of the literature showed that reports of a large series of bone tumors were practically nonexistent. The method used in this study was as follows: (1) only cases of tumor were used, thus eliminating such conditions as Paget's disease, scurvy, rickets, osteitis fibrosa cystica, and dental tumors; (2) only cases were used which had been convincingly diagnosed in the hospital by biopsy and in which adequate follow-up was possible; (3) a count was made of all tumor cases recorded in the office of the Campbell Clinic and the records of the Pathology Department were studied to determine the number of cases in which biopsy material was available. The tumors were divided into benign and malignant types. The clinical histories of all patients with malignant tumors were studied and each suitable case was analyzed.

The study showed that 0.8 per cent of all orthopedic patients seen at the Campbell Clinic were suffering from some sort of bone tumor, benign or malignant. More tumors were malignant than benign. Ewing's tumor was the most common. Next in order was metastatic malignant tumor, then osteogenic sarcoma, chondromyxosarcoma, fibrosarcoma and multiple myeloma. Comparison of their study with one made nine years earlier seemed to bear out the warning that favorable results after five years in cases of Ewing's tumor do not assure freedom from metastasis. On the other hand, they believe that five-year favorable results in other malignant bone lesions are much more indicative of a permanent cure. The results in malignant bone tumors, the authors found, were almost invariably bad. However, cures of over five years' duration occurred in Ewing's tumor, osteogenic sarcoma, chondromyxosarcoma and fibrosarcoma. They regard early amputation followed by irradiation as the most logical treatment.—*R. S. Bromer, M.D.*

Stewart, Marcus J., and Otis, E. James, Jr. Giant-cell tumor confined to the greater trochanter; case report. *J. Bone & Joint Surg.*, April, 1950, *32A*, 439–442.

A case of giant-cell tumor confined to the greater trochanter in a girl, fourteen years of age is reported. The case is interesting because of the fact that the signs, symptoms and findings were in keeping with a diagnosis of giant-cell tumor, although the initial roentgenograms and physical findings were compatible with tuberculosis. A second interesting point was the location of the tumor in the greater trochanter only. A review of the literature revealed no instance of a giant-cell tumor entirely confined to the greater trochanter, although a number of cases have been reported of giant-cell tumors of the proximal portion of the femur, some of which have involved the greater trochanter.—*R. S. Bromer, M.D.*

D'Alo, Roberto. I plasmocitomi (isto-patologia e quadro radiologico). (The plasmocytomas; histopathology and roentgen appearance.) *Radiol. med.*, April, 1950, *36*, 273–288.

In the introduction, the author considers the histogenesis of the myelomas. He accepts the designation plasmocytoma, proposed by Göhn and Roman in 1914, the common histological characteristic of the disease being the presence of atypical plasma cells.

The probable derivation of the myeloma cells from reticulum cells or reticulo-endothelial cells is offered as an explanation for the variation in cell types, since the reticulum cells may be potential sources of all types of cells.

The myeloma may be composed of more or less mature plasma cells or of plasma blasts in an earlier stage of development.

The possible relationship of the plasmocytoma to the reticulum cell sarcoma is stressed by the author

There are two general types of myelomatous infiltration in bone: (1) a diffuse infiltration, in which tumor cells may also be found in the blood stream as in the plasma cell leukemias, and in which there may be involvement of the liver, spleen, and lymph nodes; (2) a nodular infiltration, which may be discrete or confluent.

Roentgenologically the diffuse infiltration of the bone marrow (15 per cent of cases) may not be demonstrable. Occasionally a generalized bone demineralization with cortical and trabecular thinning may be recognized. The clinical syndrome, pain, spontaneous fracture, cachexia, Bence-Jones proteinuria, hyperglobulinemia, and positive sternal puncture smears are of greater diagnostic significance.

The nodular forms of infiltration produce the classical roentgen findings of multiple, rounded, punched-out areas of bone rarefaction with predilection for the flat and short bones.

In later stages, when confluence of the nodular lesions takes place, the roentgen signs are not as characteristic. The osteolytic lesion may be irregular and atypical.

The sternum and especially the manubrium sterni is not infrequently a primitive site of the neoplasm. There it assumes the appearance of a giant cell tumor, with characteristic thinning of the cortex, expansion, and trabeculation.

This cystic appearance of the disease may be observed in other bones.

▶ The principal disease entities to be considered in the differential diagnosis are: (1) giant cell tumor; (2) eosinophilic granuloma; (3) Ewing's sarcoma; (4) osteolytic metastasis.

In the author's opinion solitary myeloma and multiple myeloma represent the same pathological process in different phases. The disease may remain localized for a relatively long period of time or may become generalized within a variable interval of a few months to a few years.

Surgical resection of solitary lesions followed by radiotherapy, palliative roentgen therapy for multiple lesions are the therapeutic measures advised by the author.

According to the literature, untreated cases of multiple myeloma have a survival time of three to six months, treated cases, of eleven to twenty months. —*A. A. Blasi, M.D.*

COLEY, BRADLEY L., and HARROLD, CHARLES C., JR. An analysis of fifty-nine cases of osteogenic sarcoma with survival for five years or more. *J. Bone & Joint Surg.*, April, 1950, *32A*, 307–310.

The material for this study consisted of 59 five year survivals of osteogenic sarcoma, from a group of 252 determinate cases treated during the period from 1917 through 1943 at the Memorial Hospital, New York. As a result of the survey, the authors believe it is worth while to attempt to separate the more commonly encountered varieties of osteogenic sarcoma (used in its broadest sense), because the prognosis is distinctly better in some types than in others. The tendency for fibrosarcoma and chondrosarcoma (mainly the low grade "secondary chondromyxosarcomata") to metastasize later than "osteogenic sarcoma" is a clinical impression which their study seems to confirm. They believe that the microscopic appearance of tissue taken from the tumor affords the most reliable index of the rapidity of growth and its tendency to early or late metastasis. Exceptions are, however, not unusual. Their series includes some cases in which a favorable outcome was considered highly unlikely; and, on the other hand, in cases deemed of slow growth with likelihood of survival, the patients died within five years from pulmonary metastatis.

The greatest number of cases of survival were treated surgically. Difficulty was found in the evaluation of irradiation. Most of the cases in which it was used were treated in the period prior to 1940 when a high proportion of patients having amputation received preoperative roentgen therapy. In the past five years, preoperative roentgen therapy has been virtually abandoned, so it will soon be possible to make a comparative study of sizable groups treated by amputation, with or without preoperative irradiation.

Routine postoperative toxin treatment was abandoned several years ago. There were no five year survivals in the series of osteogenic sarcoma, including fibrosarcoma and chondrosarcoma, where the lesion was located in the proximal end of the femur. They conclude that, if a patient with osteogenic sarcoma survives for five years, his chances of escaping further evidences of this disease are approximately twelve to one. Lobectomy for pulmonary metastasis, discovered late in the course of the disease was carried out in 2 cases of the series.

The authors hope that this report of a list of 59 carefully authenticated cases of osteogenic sarcoma in its various forms may help to dispel the attitude that this disease is uniformly fatal and that therapy is is of so little value as to call for no great effort to reach an early diagnosis and to institute prompt appropriate treatment.—*R. S. Bromer. M.D.*

MIDDLEMISS, J. H. Tomography and its application to investigations of the spine. *J. Faculty of Radiologists*, April, 1950, *1*, 273–298.

Although tomographic technique has been known in principle for over twenty-five years and has been

in general use for more than twelve years, and although it has been used in intracranial air studies, pelvimetry, study of the spine, sternum, paranasal sinuses, base of skull, larynx, cardiovascular system, gallbladder, kidneys, peripheral bones and joints, its use at present is largely restricted to the pulmonary, mediastinal and laryngeal structures. While an immense amount of experimental work on movements of tube, film or object to be roentgenographed was carried out during the development of the technique, it has resolved itself mainly into two types of movement—rectilinear movement (Twining and Grossman) and curvilinear movement (Ziedses des Plantes and Kieffer). The author considers it is best to retain the term "body section roentgenography" to cover all variations of the technique, to use the name "tomography" for technique employing rectilinear movement, and "planigraphy" for the technique applied to curvilinear movement.

Tomographic movement produces on a film two planed effects: (1) an image of a plane in focus; (2) a blur representing all the remaining structures within the body being roentgenographed. A third effect is unplaned blur or unsharpness which is greater than with standard technique. From a technical standpoint a compromise must be effected between the depth of the plane it is desired to demonstrate, the permissible unsharpness of shadows within that plane, and the density of the shadows of unwanted structures. If these overlying structures are dense, a large amplitude must be used to diffuse and disperse their shadows; if they are not, then a reduction in amplitude will bring more of the desired object into focus at one time and will also reduce the unsharpness of the image. Where fine detail of the object is required, a greater amplitude must be used, but this in turn will cause loss of some detail due to increase of unplaned blur.

A brief review of the literature on tomographic investigations of the spine is given. The publication by Weinbren "Manual of Tomography," 1946, and the papers by R. Herdner, in 1947, 1948, are considered of especial value.

The factors needed for satisfactory technique include: (1) an anode-film distance equal to the radius of the Potter-Bucky grid; (2) slight increase in exposure factors over those used for standard routine roentgenography; (3) uniform movement of tube stand along the rail; (4) accurate roentgenographic technique and immobilization of the part. Certain regions are much more suitable for demonstration by tomography than by standard technique. Among these are anteroposterior views of the cervical spine, lateral projections of the cervicodorsal spine, and lateral or anteroposterior projection of the lumbosacral junction.

Tomography has been found useful in selected cases of tuberculosis, juvenile and adolescent osteochondritis, spondylitis ankylopoietica, and fracture. It is also an aid to differential diagnosis in certain cases of vertebra plana, chondro-osteodystrophy and possibly neoplastic disease. Several case reports and good illustrations are included in this article.

The general indications for the use of tomography listed by Middlemiss are: (1) to establish diagnosis when not already accomplished; (2) to produce an adequate demonstration when this cannot be done by a standard technique because of a difficult anatomical site: (3) to define the full extent or the progress of a lesion; (4) to demonstrate whether or not activity still exists in a disease process.

The author believes that for tomographic technique to improve in the future to the point where detail will be as satisfactory as with standard technique, apparatus should be redesigned. Vallebona in 1930 devised an apparatus whereby the roentgen tube and film remained stationary and the patient was rotated about a predetermined adjustable axis. This was later elaborated by Herdner for use with the patient in the upright position. Such equipment if further improved, Middlemiss believes, would do much to eliminate unsharpness and to enhance the value of tomographic technique.—*S. G. Henderson, M.D.*

Ford, Lee T., and Key, J. Albert. An evaluation of myelography in the diagnosis of intervertebral-disc lesions in the low back. *J. Bone & Joint Surg.*, April, 1950, *32A*, 257–266.

This paper is a report of the authors' attempts to correlate the findings in the myelograms with operative findings in 206 cases. Myelograms were performed in 253 cases of low-back pain. One hundred and thirty-seven positive and 12 negative myelograms were confirmed at operation. Minor discrepancies were noted in 17 cases, or 8.3 per cent, and major discrepancies in 40 cases, and 19.4 per cent. In 230 cases, 3.3 cc. of pantopaque was used with 10 reactions. In 23 cases, larger amounts (6.6 to 17 cc.) were used with 6 reactions, or 26 per cent. Use of more than 3.3 cc. was found to be of doubtful value and, even though most of the medium can be removed, the technique is not to be recommended because of higher incidence of reactions.

The most significant errors occurred in the 27 patients with negative myelograms and positive operative findings, who were operated upon because of the severity of their symptoms. Had the authors assumed a high diagnostic accuracy of the myelograms, most of these patients might not have been operated upon. Of the ten major discrepancies in which the myelogram was inaccurate as to the level of the lesion, it is possible that designation of the interspace by the surgeon at operation was faulty. Apparently, however, this was not the case as the authors' custom is to identify the posterior surface of the sacrum early in the operation and to use this for orientation.

In view of their findings, Ford and Key summarize their experience as follows: they shall continue to use myelography in the study of patients with low-back pain, with or without sciatica, but probably only in selected cases. The procedure adds to the cost of the patient's illness; it may add to the period of hospitalization; it may be followed by unpleasant reactions; it may give false information. On the other hand, it is a valuable but not infallible, adjunct in the diagnosis of disc lesions; it is of considerable value as evidence in compensation of medicolegal cases; and it may be of considerable help to the surgeon in deciding whether or not he should operate in certain borderline cases.

The reactions took the form of headaches, stiffness of the neck, low-grade fever (2 cases), meningismus (2 cases), ileus (1 case) and increased cell count in the only 2 cases in which the spinal fluid was examined after the injection. In some cases, the reactions were so severe that the operation was postponed for a few days.

In studying the spot films, a search was made for the following types of defects: (1) a lateral indentation in the outline of the dural sac, (2) an hourglass constriction or stricture type of defect which would suggest bilateral protrusion of a single disc, (3) striation of the column of medium near the margins of the sac, (4) asymmetry or failure of the axillary root sleeve to fill with the opaque medium on one side, although it fills and presents a normal appearance on the opposite side, (5) anterior indentations in the column, visible in the lateral view, (6) a block type of lesion with more or less obstruction of the canal.—*R. S. Bromer, M.D.*

BÜCKER, J. Die Luftmyelographie beim Bandscheibenprolaps. (Air myelography in herniation of the intervertebral disc.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1950. *72*, 493–497.

Because of the serious complications that arise after the use of iodipin or perabrodil intrathecally and lacking a better contrast medium, the author used air myelography in 60 cases with clinical symptoms of herniation of the intervertebral disc. In 6 cases definite positive findings were noted which were confirmed by surgery in 5 instances. The sixth case was not operated upon. Histories of these 5 operated cases are outlined, illustrated with a roentgenogram in each case.

In discussing the merits of air myelography the author mentions the absence of side effects when air is introduced through the lumbar region, but admits its diagnostic limitations. He found the procedure helpful only when the lesion is of considerable size. The sagittal projection is of no value and herniation at the lumbosacral level is not detected even in the lateral projection. Furthermore, it is necessary that the general physical conditions be favorable as obesity, thick musculature, large diameter, etc., may obscure details.

The author also mentions that a survey film could not be relied upon as, in his experience, the prolapse was in many instances several segments higher or lower than the intervertebral disc that showed the most changes which he attributes to degenerative changes of the entire spine or a large segment of the spine.—*Salomon Silvera, M.D.*

ALBRECHT, KLAUS, and DRESSLER, WILLI. Die Kontrastdarstellung des Periduralraums (Peridurographie). Eine Möglichkeit zur Erkennung krankhafter Veränderungen der Wirbelkörper and Bandscheiben. (The contrast delineation of the peridural space [Peridurography]. A method of diagnosis of pathologic changes of the vertebrae and intervertertebral discs.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, April, 1950, *72*, 703–708.

The author condemns myelography for diagnosis of disc lesions because the contrast material used (iodipin) is too irritating and must be removed completely if reactions are to be avoided. Injection of perabrodil into the peridural space of the spinal canal is the method of choice to demonstrate herniation of the nucleus pulposus and tumors of the vertebrae. The technique of injection is described; 20 cc. of 35 per cent perabrodil mixed with 15 cc. of 3.3 per cent pantocain (local anesthetic) are used. Only lateral and oblique views of the spine are taken five to ten minutes after injection. A good portion of the perabrodil is absorbed twenty minutes after injection. Large epidural veins may produce false positive findings.

Peridurography yields at least as good results as myelography, causes less reaction, and is less time consuming.—*F. M. Reis, M.D.*

TOUMEY, JAMES W., POPPEN, JAMES L., and HURLEY, MELVIN T. Cauda equina tumors as a cause of the low-back syndrome. *J. Bone & Joint Surg.*, April, 1950, *32A*, 249–256.

The purpose of this paper is to stress the ever-present possibility of serious error in the diagnosis of low-back conditions, and to emphasize the difficulties in the diagnosis of cauda equina lesions. The authors report 48 cases of tumor of the cauda equina or low spinal cord in which operation was performed between 1939 and 1948. In this same interval 1,056 intervertebral disc operations were performed. The tumors represent 4.3 per cent of the entire group. The patients with tumors ranged from fourteen to sixty-eight years; the number of males and females were equal.

Early diagnosis is most important in the tumor cases. There is great similarity in the clinical picture

of tumors of the cauda equina and disc lesions. Insidious onset of pain with an unremitting course suggests tumor. Numbness and weakness of the legs is more often associated with tumor. The duration of symptoms varies from two months to eight years. The most common complaint on the series was low-back pain but 12 per cent of the patients had no pain whatever. The most common physical sign in the tumor cases was an absent or diminished ankle jerk, but this finding is common also in the disc lesions. Tumor lesions cannot usually be differentiated from disc lesions by physical signs. In 8 per cent of the tumor cases, neurological signs were not present.

The authors consider the myelogram as the most significant and valuable aid in the differential diagnosis. The use of pantopaque, removed at the time of fluoroscopy, is preferred at the present time. Complete subarachnoid blocks were present in 19 instances and xanthochromic fluid was noted in 7 cases.

Estimations of total protein ranged from 14 to 610 mg. per 100 cc., the average being 140. A protein estimation of over 100 definitely suggests tumor and is a valuable aid in diagnosis. However, in 30 per cent of the patients who had tumors, the total protein was not elevated. In the series 20 per cent of the tumors were malignant. Of the benign tumors, neurilemmona was by far the most common, with ependymoma second.—*R. S. Bromer, M.D.*

McCarty, Ray B. Presacral tumors; case report. *Ann. Surg.*, March, 1950, *131*, 424–432.

Presacral tumors are not common. They fall into four groups: (1) congenital anomalies, (2) bone tumors, (3) neurogenic tumors, (4) miscellaneous group.

The common congenital anomaly is the dermoid cyst, which is usually silent until it reaches a size to cause pressure symptoms or suppurate. It does not manifest itself until adult life. Teratoma, also a congenital anomaly, is usually found at birth. It is attached to the anterior surface of the sacrum or coccyx and grows forward and downward. The teratoma must be differentiated from a meningocele. Since the latter communicates with the spinal canal, there is expansion of the tumor when the patient coughs or cries, whereas the teratoma shows no change. Another tumor is the anterior sacral meningocele associated with an anterior spina bifida.

The most frequent bone tumor is the sacrococcygeal chordoma, which is a progressive slow growing tumor arising from the notochord and invades and destroys bone by direct extension.

The neurogenic tumors include ependymoma, neurofibroma, neuroblastoma, and ganglioneuroma.

The miscellaneous group consists of lipoma, fibroma, fibrosarcoma, sarcoma, hemangioma, and lymphoblastoma.

The treatment of these tumors is surgical excision.

The author reports a case of a presacral dermoid cyst which was successfully removed.—*J. Levitin, M.D*

Roche, Maurice B. Healing of bilateral fracture of the pars interarticularis of a lumbar neural arch. *J. Bone & Joint Surg.*, April, 1950, *32A*, 428–429.

The author encountered a case of fresh bilateral fracture of the pars interarticularis of the third lumbar neural arch without dislocation of the involved vertebral body. The patient, a man aged twenty-two, had multiple injuries. Treatment consisted of recumbency on a Stryker frame for seventeen weeks.

At the time of writing, two years and four months after the injury, the patient was regularly employed at clerical work and had no symptoms referable to his spine or other bones. He wore a Taylor spine brace for six months following recumbency. Questions have been raised as to whether the fracture sites, having apparently undergone osseous healing during the period of recumbency, would actually be absorbed under the continual strain of weight-bearing in the erect position and would eventually show defects in the neural arch; and whether, in the event of such absorption, these defects might not be similar to those usually associated with the concept of presumably congenital spondyloschisis. In Roche's case there was no evidence of absorption and no defect in the neural arch, as shown in the roentgenograms of the spine.—*R. S. Bromer, M.D.*

Blood and Lymph System

Felder, Davitt A. A method of venography. *Radiology*, April, 1950, *54*, 516–520.

A method of venography of the deep veins of the lower extremity is presented. A 35 per cent solution of diodrast was injected at the rate of 5 cc. every twenty seconds, using a total of 20 cc. The roentgenographic table was tilted some 15 degrees with the foot end down and a tourniquet placed snugly about the lower leg about 8 cm. above the medial malleolus. This occludes the superficial veins, but leaves the deep veins patent. Two sets of stereo films were taken routinely. One set centering on the upper half of the leg and the second centering on the mid-thigh.

The procedure was applied in 65 extremities in 48 patients. A high visualization percentage was found for the peroneal, posterior tibial, popliteal, and femoral veins.—*A. W. Sommer, M.D.*

Felder, Davitt A. Anatomical-spatial relationships of the deep veins of the lower extremity as a basis for venographic interpretation. *Radiology*, April, 1950, *54*, 521–526.

A detailed anatomical-spatial relationship of the deep veins of the lower extremity is given. This is

too extensive to cover in an abstract, but is worth reading for anyone interpreting venograms of the lower extremity.

Since veins are usually obscured by bones in the antero-posterior roentgenogram, the author advocates rotating the leg inwardly about 45 degrees, thus enabling one to better visualize the injected veins. By making stereoscopic roentgenograms the various deep vessels can usually be identified by their anatomical-spatial relationships.—*E. E. Seedorf, M.D.*

FRIMANN-DAHL, J. Roentgen examination in acute thrombosis. *Radiology*, March, 1950, *54*, 408–412.

In a discussion of the diagnosis of acute thrombosis based on roentgen examination of the soft tissues of the extremities, the ease of the method, reliability and certain advantages over venographic examination are emphasized. Soft tissue technique using 40–50 kv. is recommended.

Changes which are due to edema and dilatation of subcutaneous vessels are demonstrable in soft tissue as early as the first or second day after onset of the attack. These are: (1) thickening of cutis line, (2) accentuation of reticulated subcutaneous structures, (3) widening of greater vessels, (4) increased density of muscle shadows and obscuration of their margins, and (5) broadening of the extremity. Progress of the disease or effect of treatment may be followed on repeated examinations.

Use of this method may be combined with venography if necessary to obtain clearer evidence as to location of the thrombus and extent of secondary circulatory disturbances.—*A. W. Sommer, M.D.*

PRAT, DOMINGO, and GUELFI, A. GARCÍA. Flebitis y trombosis venosas. (Venous phlebitis and thrombosis.) *An. Fac. de med. de Montevideo*, 1950, *35*, 219–246.

According to Prat and Guelfi, the excellent results of the modern methods of therapy in thrombophlebitis depend, to a large degree, on early and accurate diagnosis by means of phlebography. In the typical phlebogram, thrombophlebitis manifests itself by filling defects in one or more principal vascular trunks with the so-called "worm-eaten wood" appearance of the internal outlines of the affected vessels. Characteristic edema and escape of dark blood under tension from the exteriorized vein at the time of exploration are considered important clinical factors during phlebography. The interruption or marked diminution of the circulation in the area of the thrombus results in a detour of the major blood volume through channels which ordinarily are not utilized during rest. The salient features of the thrombophlebitic picture as obtained by phlebography are demonstrated by roentgenograms of several cases. In contradistinction to some clinicians, the authors do not consider phlebography dangerous, not even in acute cases of thrombophlebitis, if done by an experienced technician and if the clinical indications and safeguards are not neglected.—*E. A. Schmidt, M.D.*

GENERAL

CAFFEY, JOHN. Chronic poisoning due to excess of Vitamin A; description of the clinical and roentgen manifestations in seven infants and young children. *Pediatrics*, April, 1950, *5*, 672–688.

The author has encountered 7 cases in five years of patients who have ingested excessive amounts of vitamin A and D concentrate over long periods of time and who have presented similar clinical, roentgenographic and chemical findings. The case histories of the 7 cases are discussed in detail. The author also discusses acute vitamin A poisoning and experimental poisoning. Five cases of chronic vitamin A poisoning have been discussed in the literature prior to the author's 7 cases.

In all cases the ingestion of excessive amounts of vitamin A was unknown to the pediatrician in charge. In taking histories where vitamin A poisoning is suspected it is important to have the mother describe in detail how the dosage is measured, the preparation used and the frequency of feedings. The parents of course, are not aware of the potential harm of over-feeding.

Clinically a latent period ensued between the start of excessive feedings of the vitamin concentrate and the onset of symptoms. This period ranged from six to sixteen months in the author's cases. The onset was usually manifested by the appearance of tender swellings. Pruritus and anorexia may precede the tender swellings. Vitamin D poisoning may be responsible for the anorexia. Hyperirritability and limitation of motion usually occurs with the tender swellings. These swellings were most common in the forearms but were more conspicuous in the shanks and feet in some patients. The swellings were deep and apparently attached to bone.

In every patient hyperostoses were demonstrable roentgenographicaly in two or more of the long bones. These were always under soft tissue swellings. All 7 cases had involvement of both ulnas. One or more of the metatarsals were involved in every case. The femurs and humeri were spared in all but one case. The hyperostoses have a shell-like appearance with a zone of lessened density between the new bone and the old cortex. When vitamin A is withdrawn the rarefied zone disappears and the new bone gradually merges with the old cortex. The cortical thickening is perceptible for many months.

All patients have shown increase in vitamin A blood levels, which have varied from 400 to 2,000 u./100 cc. Recovery is rapid following discontinuance

of the vitamin therapy. Symptoms usually disappear within one week.

The disease has been confused with infantile cortical hyperostosis. The only two common findings are the tender swellings and the cortical hyperostosis. The following are differential diagnostic points:

1. Infantile cortical hyperostosis appears in the first four months of life while signs of vitamin A poisoning do not appear until after twelve months.

2. The face and mandible have been involved in every case of cortical hyperostosis but spared in vitamin A poisoning.

3. The constancy of involvement of the metatarsals in vitamin A poisoning has not been noted in cortical hyperostosis.

4. Vitamin A levels are elevated in vitamin A poisoning and normal in cortical hyperostosis.

5. Fever is the usual finding in cortical hyperostosis but is not found in uncomplicated vitamin A poisoning.

6. There is a history of excessive vitamin A ingestion in poisoning cases which is absent in hyperostosis cases.

7. Symptoms disappear rapidly in poisoning cases after withdrawal of vitamin A but persist in cortical hyperostosis in spite of treatment for weeks and months.—*R. M. Harvey, M.D.*

Akwa, Carl M., Kanter, Joseph, and Markson, Leonard S. Multiple idiopathic hemorrhagic sarcoma: case report (idiopathic multiple pigmented sarcoma). *Urol. & Cutan. Rev.*, March, 1950, *54*, 157–160.

This disease first reported by Kaposi in 1872 is fairly rare. It occurs chiefly in the older age group but may appear also in children. It is primarily a disease found in males who have lived in Mediterranean countries and while it has been reported to involve many areas in the body, the chief area of involvement is distinguished by bluish-red or reddish-brown nodules varying in size from millet seeds to pea size and usually in the skin of the extremites. These lesions are infiltrations of firm consistency and may be painful on pressure.

In this article a case of hemorrhagic sarcoma of thirty-one years' duration is presented. The skin lesions in this patient were radiosensitive and radiation therapy did not prevent the formation and spread of new lesions.

The article is accompanied by several photographs of the skin lesions and photomicrographs showing the histopathological appearance.—*G. W. Chamberlin, M.D.*

Heller, Elwyn L., and Sieber, William K. Fibrosarcoma; clinical and pathological study of sixty cases. *Surgery*, April, 1950, *27*, 539–545.

The authors present a summary of the clinical and pathological features in 60 cases of fibrosarcoma which were observed in a period of seventeen years. Twenty-three of the patients were men and 37 were women. Although fibrosarcoma may arise from almost any tissue of the body, its predominant origin from the deep fascial planes and from the muscles and nerve sheaths of the trunks and extremities is exemplified by this group of cases. Features of possible etiologic significance included trauma, chronic irritation, and pre-existing benign lesions. In 1 case, a sledge hammer blow to the right thigh was followed in four months by the appearance of a fibrosarcoma. Diagnosis was established by biopsy. There were 2 instances of fibrosarcoma in patients who also had multiple neurofibromatosis. One of these tumors occurred in an area of osteitis fibrosa cystica in a patient who had a parathyroid adenoma. In these cases the clinical course was variable; the chief symptom usually was a palpable mass. The primary tumors were superficial in 39 of the 60 cases. There was an average interval of eleven months between the appearance of the mass and the establishment of the diagnosis.

In cases in which the patients were not treated, the course was uniformly fatal. Death resulted from widespread metastasis, malnutrition, intercurrent infection or massive hemorrhage. The duration of the life from the onset of the first symptom to death in the cases in which the patients were not treated averaged 31.5 months. Biopsy is recommended as the diagnostic procedure of choice but the complication of uncontrollable arterial hemorrhage should be considered. The gross and microscopic features of this type of tumor are described and in all cases the malignancy was graded according to Broders' classification based on the histopathologic and cytologic features. In 11 of 22 cases, the tumors recurred within one year after surgical excision. Blood-borne metastasis was the rule, but involvement of regional lymph nodes was observed in approximately 5 per cent of the cases. Twelve of the 60 patients are now living.

Treatment consisted of radical operation in 21 cases, local excision and roentgen therapy in 8 cases, and roentgen therapy alone in 12 cases. Roentgen therapy alone resulted in no cures. The duration of the tumor prior to the institution of therapy showed no correlation with the clinical course, and offered no aid in prognosis. There was no close parallel between the histopathologic grade of the tumor and the clinical course. The grade of malignancy, however, apparently reflects the rate of tumor growth.—*C. B. Holman, M.D.*

Botsford, Thomas W., and Tucker, Martha R. Application of cytologic smear methods to cancer diagnosis in a general hospital. *J.A.M.A.*, April 1, 1950, *142*, 975–979.

This is a report of three years' experience in cyto-

logic cancer diagnosis at the Peter Bent Brigham Hospital. Appropriate smears were examined routinely on all patients; that is, all patients seen in the gynecologic clinic, and all females hospitalized had vaginal smears. In addition, urinary sediment smears were made on all admissions to the urologic service, etc.

A standard technique was used, although solutions to some special problems are reported. The average cost per smear was one dollar.

Altogether 3,000 vaginal smears were made. The results in 65 uterine carcinomas showed a diagnostic error of 9.2 per cent by a single initial smear. A false positive error was made in 21 of 2,935 patients. Of most importance, however, is the fact that of 10 patients with unsuspected uterine carcinoma, a primary diagnosis was made in 9 by a single vaginal smear.

Of 295 urologic patients, 78 had carcinoma, and all but 2 showed tumor cells in the first smear. There were 12 false positive smears.

Seventeen of 23 patients with gastric carcinoma had positive smears; false positives were reported in 4 of 101 patients.

Sixteen of 19 lung carcinomas were reported, with 5 false positives in 102 patients. Examination of bronchial washings proved much more satisfactory than sputum smears.

The authors emphasize that the cytologic diagnosis of cancer is not infallible, does not replace or contraindicate any other method of diagnosis; a negative smear never guarantees the absence of cancer and in no way should influence the ordinary clinical indications for further clinical examination. However, many instances of early cancer have been first diagnosed by this method.—*A. A. Brewer, M.D.*

LEES, JAMES C., and LEES, THOMAS W. Numerical estimation in cancer and cancer treatment. *Cancer*, May, 1950, *3*, 377–409.

This is a long article on methods and figures for doing accurate research in regard to cancer and its treatment.

The difficulties and fallacies in many research reports are discussed in detail.

The paper should probably be read in its entirety by anyone writing papers dealing with cancer statistics or treatment.—*R. C. Datzman, M.D.*

RADIATION THERAPY

ELLIS, FRANK, SHANKS, W., KEMP, L. A. W., and OLIVER, R. The use of wedge filters in x-ray therapy. *J. Faculty of Radiologists*, April, 1950, *1*, 231–244.

The authors propose the use of wedge filters in routine roentgen therapy in order (1) to give a lethal dose to tumor tissue and the adjacent apparently normal tissue in the immediate neighborhood; (2) to minimize the volume of uninvolved normal tissue treated; (3) to ensure a uniform lethal dose throughout the volume of tissue treated; (4) to more precisely determine the dose necessary for a lethal effect on tumor cells. The automatic dose explorer (Kemp, 1946) now readily permits the investigation of wedge techniques to ensure satisfactory dose measurements.

The wedge consists of a non-uniform metal filter whose thickness varies in one direction across the field. The filter is mounted on the end of a wooden, lead-line applicator, having a limiting diaphragm of 23.5 cm. focal distance. The wedge is made of a series of brass laminations, with steps 0.5 cm. wide and running parallel to one edge of the field. A cover of a 1 mm. aluminum filter and a 5 mm. perspex sheet result in a focal-skin distance of 30 cm. for the applicator. This short focal-skin distance makes the wedge dosage rates comparable with those obtained with normal fields. Measurements of dose distribution in a water phantom are made using the automatic dose explorer.

A set of wedges at present in use is designed to give isodose curves of approximately 45° slope. If two such fields are arranged at right angles a very uniform dosage results along the diagonal of the square, with a quick fall off beyond this. Another useful combination of two wedge fields together with a central normal field in a hemihexagonal arrangement results in a very uniform dosage over a considerable volume, with a quick fall off in dose at greater depths. This arrangement has the advantage of fitting many body contours. Two opposed wedge fields with a normal field at right angles also give very uniform dosage. This arrangement is particularly useful in cerebral treatments.

The use of these techniques in larynx (purely intrinsic, and extensive or extrinsic laryngeal lesions), posterior tongue, antrum and ethmoid sinuses, nose, chest, abdominal wall, limb, and cerebral treatments is described, and illustrative photographs are presented. Treatment of superficial lesions on a curved surface with the use of a shallow wedge with isodose curves of less than 45° is also mentioned.—*S. G. Henderson, M.D.*

ARKIN, ALVIN M., and SIMON, NORMAN. Radiation scoliosis; an experimental study. *J. Bone & Joint Surg.*, April, 1950, *32A*, 396–401.

The use of external radiation (roentgen-ray beam) has advantages in suppressing vertebral epiphyseal growth. Fields of radiation may be varied easily, and surgical implantation is not necessary. Also, there are regions along the spine, particularly in the thorax where it would be difficult to insert radium needles or radon. The authors found that structural scoliosis can be produced in the spines of rabbits by irradiating the vertebrae asymmetrically. The resulting unequal bone growth yields wedging of the vertebral bodies with the lesser height toward the irradiated

side. A single dose of 1,000 r is required to induce definite wedging in the spines of young rabbits.

The radiation was directed toward one side of the lumbar vertebrae, through a portal on the dorsum of the animal. The field measures 1 by 7 cm., and the roentgen-ray factors were: 140 kv., 20 ma., target-skin distance of 30 cm., filtration 0.25 mm. of copper, 1 mm. of aluminum, a half-value layer of 0.50 mm. of copper, 60 r per minute. The dose at the epiphysis was 1,000 r. Localization of the radiation beam was verified by taking roentgenograms with the therapy machine set for treatment.

The irradiated half of all epiphyseal plate showed a cessation of growth, as indicated by the absence of cartilaginous columns. None of the animals showed gross or microscopical evidence of necrosis, marrow fibrosis, or inflammatory infiltration. The bone wedging apparently was not the result of pressure from contractural scarring in the concavity of the curve (due to radiation), as the intervertebral discs were wider, indicating less pressure on this side. In fact, the discs indicated that more pressure was falling on the higher side of the bodies and, if the radiation arrest were temporary, the rabbits' efforts at functional correction might be expected to lead to improvement or eventual disappearance of the structural scoliosis. By their method, direct unilateral suppression of epiphyseal growth can be controlled to produce wedging in a predictable area, an effect which may be applicable in clinical scoliosis.—*R. S. Bromer, M.D.*

Arkin, Alvin M., Pack, George T., Ransohoff, Nicholas S., and Simon, Norman. Radiation-induced scoliosis; a case report. *J. Bone & Joint Surg.*, April, 1950, *32A*, 401–404.

The case report demonstrates the development of scoliosis in a patient whose spine had been heavily irradiated in early childhood. No similar case has been reported in the literature. The patient was a thirteen year old schoolgirl whose chief complaint was curvature of the spine which had developed gradually and painlessly over a period of years. She had been treated during her infancy for pigmented diffuse nevi on which discrete coal-black melanotic tumors had developed which were excised. When nineteen months old, a large mass was palpable in the left side of the abdomen and a clinical diagnosis of Wilms' tumor (embryonal adenomyosarcoma) was made and the patient was treated by preoperative irradiation, nephrectomy and postoperative irradiation. Before operation the patient received a total of 1,100 r in air over each of three fields over the left kidney area. One month after the irradiation, the left kidney was excised. The histological diagnosis was embryonal adenocarcinoma, grade 3. It was not described as a typical Wilms' tumor, since there were many embryonal tubules and abortive glomeruli. No radiation changes were seen in the specimen. Postoperative treatment consisted of three fields as before operation except that the fields were smaller. Each received 2,100 r in air. Roentgenograms showed no scoliosis.

When the child was nine years of age, the scoliosis was noted as "marked scoliosis of the dorsolumbar region." The scoliosis at the age of thirteen showed several indications that it was not an "idiopathic" scoliosis fortuitously occurring in a previously irradiated spine. It differed from the usual scoliosis in that the isolated lumbar curve exactly followed the field of irradiation and the wedging was directed toward the irradiated side. In addition to the inhibition of growth in the left half of the vertebral bodies, there was inhibition of growth in the left twelfth rib, the left lumbar transverse processes, and the left ilium, all included in the field of irradiation. Moreover, in ordinary or idiopathic scoliosis, the wedging is maximal at the apex and diminishes gradually toward the ends of the curve. In the patient the wedging was uniform throughout the lumbar spine. The authors regard it as reasonable to assume that the radiation from each of the three fields affected the left side of the spine substantially more than the right.—*R. S. Bromer, M.D.*

Dameshek, William. Physiopathology and course of polycythemia vera as related to therapy. *J.A.M.A.*, March 18, 1950, *142*, 790–797.

The inhibiting factors to the production of blood within the marrow of the bones seem to be absent in polycythemia vera. This causes an increase in the number of circulating red cells, leukocytes and platelets. There are two highly speculative possibilities as to the cause of this enormous productivity of the bone marrow; (1), the presence of excessive bone marrow stimulation by an unknown factor or factors, and (2) a lack or a diminution in the normal inhibitory factor or factors.

The two most important end results of the extreme degree of panmyelopathy and pancytosis in polycythemia are the development of an enormous mass of red blood cells in the circulation and a marked increase in the total volume of blood. The great mass of blood in the circulation has at least three outstanding effects: (1) plethora, (2) decreased velocity of blood flow and (3) increased viscosity of the blood. Peripheral vascular lesions are common and thromboses occur frequently. The author found gastric ulcers in 1 out of every 5 patients, presumably due to thromboses within the stomach. Arteriosclerosis is more common in patients with polycythemia vera than in the general population.

If the individual with this disease lives long enough and does not succumb to the effects of thromboses or other complications, the bone marrow will often gradually show signs of diminished activity. The red

cells decrease in number and within the marrow cavity fibrous tissue develops. This causes hematopoiesis to begin in the spleen. As a result, this organ enlarges greatly. Immature white and red cells are seen in the circulation, perhaps due to the lack of the normal regulatory effect of the spleen in the presence of the myeloid metaplasia involving the organ. Continued myelofibrosis leads to increasing anemia, leukopenia, granulocytopenia, thrombopenia and finally death.

Treatment is a long range project directed at the removal of excessive blood from the circulation or the reduction in marrow activity by means of chemicals or irradiation. There are two types of treatment by irradiation: (1) high voltage roentgen therapy to the bones or as a general body irradiation, and (2) radioactive phosphorus. There is some question as to the leukemogenic activity of roentgen rays and radioactive phosphorus, and for this reason the author restricts the intravenous use of radioactive phosphorus to those patients having frequent thromboses in the presence of an extremely high platelet count or to patients with an unusual degree of refractoriness to therapy with venesection. The excessive blood in patients with polycythemia vera can be removed and used for transfusions. When the patient has been depleted of his extra blood by venesection, a low iron diet is prescribed. As a result the nature red cells are smaller than normal and occupy less room in the circulation than do normal cells. After three to eighteen months the hematocrit rises again and venesection is done again.

In the abstract of discussion, Dr. Paul Reznikoff stated that nitrogen mustard had been used in this disease for a year or two with rather spectacular results, but gave no definite figures.

Dr. Edward H. Reinhard mentioned that among 130 patients with this disease treated by radioactive phosphorus, 2 developed a terminal leukemia. Both of these patients had been given more radioactive phosphorus than the usual patient.

Dr. Perk Lee Davis said that his group had been treating 2 patients with amino-an-fol, an enzyme inhibitor, with good responses so far.

Dr. F. W. S. Modern reported the case history of a man with polycythemia vera treated by roentgen irradiation to the stomach. This caused a marked fall in the gastric acidity and in the red and white blood counts. This man has continued for 5 years without relapse.

Dr. John Lawrence stated that leukemia is a common and a natural complication in polycythemia vera and quoted various articles in which the percentage varied from 17 to 24 per cent. He believes that there is no evidence to show that radioactive phosphorus has increased this complication. Among 150 patients observed by him 5 died of leukemia. Three of these had been treated with radioactive phosphorus. In his experience extending over a ten year period, patients with polycythemia vera treated with radioactive phosphorus lived, on the average, 16.3 years after the onset of the disease. The average age at death was sixty-seven years, nearly a normal life expectancy.—*F. J. Rigos, M.D.*

Pohle, E. A., and Weissman, I. Roentgen therapy of Cushing's syndrome (pituitary basophilism): report of a case observed for eleven years. *Ann. Int. Med.*, March, 1950, *32*, 542–548.

Because of controversy in the literature about the efficacy of roentgen therapy in treatment of pituitary basophilism, the authors report a case so treated with survival of eleven years. The patient had the classical clinical picture of basophilic adenoma of the pituitary. No adrenal tumor was found by exploratory laparotomy. In the first year of observation the patient received four courses of roentgen therapy to the pituitary and although the dose into the pituitary is not stated the approximate dose would have been about 3,200 roentgens. Following the roentgen therapy, the patient gradually improved and for the next ten years was entirely free of any symptoms or signs of his original disease. He then returned with a rapid recurrence of symptoms including headaches and progressive weakness. Additional radiation therapy to the pituitary produced no improvement and a right frontal craniotomy was performed and hypophysectomy attempted. Following operation the patient's condition became rapidly retrogressive and he died. Autopsy showed atrophy of the pituitary tissue and diffuse hyperplasia of the cortical cells of each adrenal gland. The authors postulate the theory that the original condition was controlled by radiation therapy until, for some reason the adrenal glands became hyperplastic at which time recurrence of the symptoms appeared.

This instructive case illustrated the fact that heavy dosage of roentgen therapy may be necessary to control this lesion when it is due to pituitary disease. It is probable that some of the poor results reported previously have been due to undertreatment. It might be advisable to plan the original treatment utilizing four portals crossfiring on the pituitary with a total dose of 2,000 roentgens on each portal, measured in air.—*R. P. Barden, M.D.*

Best, M. M., Coe, W. S., Moore, J. W., Reed, E. S., and Clay, H. L. Irradiation of the pituitary gland in hypertensive vascular disease. *Am. J. M. Sc.*, March, 1950, *219*, 276–280.

The authors studied the favorable results reported by recent investigators on the use of irradiation of the region of the pituitary gland for the treatment of essential hypertension. They employed, in their series a group of 43 hypertensive patients ranging in age from twenty-seven to sixty-five years; 25 were treated and 18 were used as controls. The patients

had extensive preliminary examinations to evaluate the cardiac and renal status and to eliminate those with specific causes for their hypertension. All patients received a bioassay for the antidiuretic hormone of the pituitary.

The roentgen therapy consisted of the use of a 200 kv. constant potential therapy machine at a milliamperage of 15. The target skin distance was 50 cm. The half-value layer was 2.4 mm. of copper. An area of 48 sq. cm. was treated on each lateral aspect of the skull. One field was treated daily with 200 r (in air) per seance. The total dose delivered in air to each field was 1,000 r. Treatments were given at twenty-four hour intervals. The pituitary area received a calculated dose of 1,100 r in ten days.

The results indicated no significant response as compared to the control group. This latter group received the same examination and procedure as the former with the only exception that no irradiation was given. Otherwise, every precaution was employed to make the circumstances identical.

Twelve per cent of the treated and 16 per cent of the control patients showed some reduction in the blood pressure (lowering of 30 points in the systolic and 20 points in the diastolic pressures). These differences, however, owing to the small percentage of individuals were thought to be statistically nonsignificant. Sixty-eight per cent of the treated and 77 per cent of the control group experienced symptomatic improvement. In no patient did the electrocardiogram revert to a normal pattern. On the contrary, in the treated group 4 patients revealed a definite trend from the normal to a left strain pattern. Repeated non-protein nitrogen determinations showed a definite change from normal to abnormal in 5 patients. Only 1 patient showed an elevated non-protein nitrogen before treatment which continued to increase during treatment. Initially 18 patients had positive serum antidiuretic assay. Following irradiation the assay changed to negative in 13. However, there was no correlation between changes in the antidiuretic assay following irradiation and symptomatic improvement.

The authors have no explanation for the symptomatic improvement other than the psychological effect of modern roentgen therapy.—*H. H. Galston, M.D.*

Sharp, George S., Williams, Herbert F., and Pugh, Robert E., Jr. Irradiation as the preferred treatment of cancer of the lip. *J.A.M.A.*, March 11, 1950, *142*, 698–707.

The authors have reviewed 208 cases of carcinoma of the lip all proved by biopsy, with analysis of results and special emphasis on the planning of an irradiation program for each individual case.

Early diagnosis and immediate radical treatment are necessary in order to achieve the best possible results. The diagnosis of these lesions has become more difficult with increasing lay education as the patients are now usually seen in earlier stages. Therefore the diagnosis must be established not only by the usual clinical examination and history but also by biopsy, which, the authors feel, has no deleterious effect on prognosis. Microscopic grading is considered of value in treatment as well as in prognosis since it furnishes a clue as to the possibility of metastases in the cervical lymph nodes.

The authors have divided the cases into four clinical stages as follows:

Stage 1: A primary growth less than 2 cm. in diameter.
Stage 2: A primary growth greater than 2 cm. in diameter but still limited to the lip.
Stage 3: A localized primary growth of any size but with operable unilateral cervical metastases.
Stage 4: A primary growth with invasion of the mandible with or without cervical metastases.

Since the best possible esthetic results are obtained by irradiation, the vast majority of cases in this series were treated with irradiation only. An individual irradiation program was planned for each case with two therapeutic criteria in mind: (1) adequate dosage of radiation to all portions of the neoplasm, leaving no viable cells, and (2) minimum possible irradiation of normal tissues below the base of the lesion.

The authors have found that 6,000 gamma roentgens delivered in one dose is adequate to destroy all tumor cells and that topical radium, alone or in conjunction with interstitial irradiation, offers ideal physical factors to obtain this dose with minimal damage to adjacent tissues.

Arrangement and placement of the radium depends upon the stage and size of the lesions. For tumors with clinical evidence of not more than 3 mm. depth of invasion, surface radium application by contact is cited as the method of choice. This was the only arrangement used in 78.1 per cent of the patients in this series and resulted in 83.2 per cent of the treated cases free of disease after five years. Two and one-tenth per cent died of the neoplasm and 14.7 per cent died of intercurrent disease without evidence of recurrence.

The plaque used consisted of ten cells of 2 mg. each with the equivalent filtration of 0.5 mm. platinum. Tissue dose, at the point of the tumor most distant from the applicator and in the center of the field, was calculated from Quimby's tables. The average dose was 450 mg. hr. (with the plaque in position 18–24 hours) giving a dose of 6,600 gamma roentgens at a depth of 3 mm. The sharp drop in radiation due to the distance factor may be seen in that dosage at 5 mm. was only 4,130 gamma roentgens and at 10 mm. 2,000 gamma roentgens.

Where the neoplasm has apparently invaded the tissues to a depth of more than 3 mm., the use of a radium applicator at a distance of 3–10 mm. from the surface of the growth is recommended. This arrangement gives a more uniform distribution of

dose through the tumor area. Exposure as expressed in milligram hours must then be increased to obtain the desired (6,000) gamma roentgen dose at the base of the lesion.

Where the lesion is less than 2 cm. in diameter and with 0.5–1.0 cm. depth of invasion, treatment is best given by a single application as this lessens the chance of later tissue breakdown. For larger lesions with similar depth of invasion, the surface area should be subdivided and each smaller area treated independently. For neoplasms greater than 1 cm. in depth where anatomic factors allow, three fields should be used to cross-fire the tumor area, preferably with the radiation source at a distance from the surfaces. The total exposure should be calculated to obtain an adequate gamma roentgen dose at the center and base of the growth.

Surface radium and interstitial needling in combination is recommended for use in deeply infiltrating and spherical growths. The amount and arrangement of radium sources may be calculated by measurement of the tumor and use of either Quimby's or Paterson and Parker's charts. This method was used in 21 followed cases, all in Stages 2, 3, and 4, with 71.4 per cent free of disease at five years and 4.8 per cent dead of intercurrent disease without evidence of recurrence.

The authors believe that roentgen therapy is also adaptable to cancer of the lip, regardless of its size and have used this method for treatment of 26 patients not tabulated in this series. Using the usual precautions to protect normal tissues, fractionated doses of 350–500 r (in air) of superficial roentgen rays (half-value layer 2.53 mm. aluminum, target-skin distance 15.3 cm.) were given daily to total 4,000–5,000 r, measured in air.

The absolute percentage of five year cures in the series presented in this paper was 84.2 which included all cases lost for follow-up and all deaths from intercurrent disease.—*R. Emerick, M.D.*

MALLENDER, L. JANET. Single exposures of superficial x-rays in cancer of the skin. *J. Faculty of Radiologists*, April, 1950, *1*, 267–272.

The treatment of small cancers by a single application of superficial roentgen rays is advantageous, from the patient's viewpoint, because it demands only one visit and does not require hospitalization, and from the radiation therapist's and hospital administration's stand because bed space is not required, radon seed or radium mold preparation is eliminated and there is essentially no hazard to the personnel.

A controlled experiment was conducted at the Leeds, England, radiotherapy center in 1943 to determine both the relative effectiveness and the radiation necrosis danger of this method of treatment. Factors used were 80 kv., 7 ma., added filter of 1 mm. aluminum, giving a half-value layer of 2.0 mm. aluminum, 150 r per minute with backscatter, approximately 15 per cent, for all field sizes employed. This attempted fixed output required alteration in the focal-skin distance, although it was nominally 15.5 cm. Open ended applicators made of chromium plated brass were used.

The cases selected were accessible skin lesions, clinically either basal or squamous cell carcinoma, not more than 3 cm. in diameter, and not extending deeply into tissue. Where the lesion was elevated above the general skin surface the dose was prescribed at skin level. The dose varied from 2,000 r in 4×5 cm. rectangular and 5 cm. circular fields to 2,500 r for lesions less than 3 cm. in diameter. In patients over seventy years of age with poorly nourished skin, the dose was reduced by 10 per cent.

Of 177 patients treated and then followed up for four years or more, 2 developed frank necrosis, and only 6 showed severe radiation damage. All healed spontaneously within three months. In this follow-up group of 177 patients 158, or 90 per cent, were cured by the first treatment, 4 were residual and 15 were recurrent. The majority of the skin failures had marginal recurrences and retreatment of these brought the four year cure rate to 98 per cent.

The author concludes that a single application of superficial roentgen radiation is an adequate and safe form of treatment and that the incidence of marginal recurrences would be greatly reduced if a margin of 1 cm. clear of the lesion was treated.—*S. G. Henderson, M.D.*

TELOH, H. A., MASON, M. L., and WHEELOCK, M. C. A histopathologic study of radiation injuries of the skin. *Surg., Gynec. & Obst.*, March, 1950, *90*, 335–348.

The present series of cases includes 121 examples of post-irradiation dermatitis following the use of roentgen rays, radium or radon.

In this study of 121 patients, 215 specimens were examined. Of these 121 patients, 34 or 28.1 per cent, showed definite evidence of carcinoma.

The epidermal changes consisted of atrophy, acanthosis, hyperkeratosis, and occasionally parakeratosis.

Dysplasia of the epithelial cells as a stage in the formation of a carcinomatosis lesion is stressed.

Vascular changes are the most commonly found pathologic lesion in irradiated skin. These changes account for the major part of the stromal picture.

The stromal changes are nonspecific and result partly from the inflammation due to irradiation and partly from the vascular changes with ischemia.

The elastic fibers are sometimes decreased in chronic radiation dermatitis although there may be an apparent increase in the milder degrees of injury.

The hair follicles and sebaceous glands are extremely sensitive to radiation injury, the sebaceous

glands being more susceptible than the hair follicles.

The arrectores pilorum undergo swelling, hydropic degeneration and atrophy and can rarely be identified as such in a chronic irradiation injury.

Malignant change occurred in 28.1 per cent of this series. Malignancy is usually localized by the stromal barrier. The fundamental biologic behavior is, however, identical with that of any squamous cell carcinoma of the skin.—*Mary Frances Vastine, M.D.*

Chantraine, H. Über Röntgenschwachbestrahlung bei Sterilität. (Mild roentgen irradiation in sterility.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1950, *72*, 497–502.

The author uses the paper of Ira Kaplan on the "Use of High Voltage Roentgen Therapy in the Treatment of Amenorrhea and Sterility in Women," Am. J. Roentgenol. & Rad. Therapy, 1948, 59, 370–377, as an introduction to a lengthy discussion on the possible hereditary damage by roentgen rays to succeeding generations. He begins with the question "Should we really forego the evidence of such an apparently efficacious procedure?" There is a strong faction which demands seriously that under no circumstances should the germ cell be exposed to roentgen rays, and that fluoroscopy or roentgenographic examination of the female abdomen should be prohibited. It follows the dictum "primum nil nocere." This dictum precludes any examination or treatment that entails the least possible danger of producing damage.

It is better to conform to the dictum "primum prodesse," or "help above all," especially since one cannot weigh the benefit derived from mild roentgen irradiation in sterility against the damage to a succeeding generation. One can say without contradiction that one-tenth of all people have worse hereditary characters than the worst case originating from roentgen irradiation. As long as one allows this one-tenth of the people to propagate one should not interdict roentgen irradiation to those women who could be helped to a pregnancy by this procedure.

The author then stresses the point that the roentgen dose must be limited to the least possible amount. He continues by estimating the amount of radioactivity of cosmic rays and compares it with the exposure received in roentgenography. The radioactivity of the earth's surface together with that of the cosmic rays amounts to about 0.75 r per year. Although part of this activity is due to alpha and beta rays, which do not reach the germ cells, the human body has the same content of radioactive substances as the surface of the earth, particularly of radioactive potassium. Therefore we have to charge the germ cells with a similar amount, representing an accumulation of 75,000 r during the last 100,000 years. According to today's concept, the human being should have degenerated to cretins long ago. Obviously the assumption is not correct. Either the lasting damage effect of the roentgen rays on the germ cells is being tremendously exaggerated or there must be a "self-repair" of the germ cells whereby bad mutations are separated.

Jüngling and Bomke estimate that the number of total spontaneous mutations is 500 to 1,000 times too large to be attributed to the cosmic and generally present radioactive rays. The equivalence for one year would amount to 375 to 750 r. During an examination for pregnancy the ovaries of the mother or child do not receive more than about 5 r. This examination has thus the same doubtful consequences on the ovaries of the child as if the conception had been postponed two and a half to five days.

The author also considers the damage done by the roentgen rays to the entire population. If, for example, 2,000 women out of 100,000 population receive roentgen exposure to their ovaries, at an average rate of 5 r per examination, every 50th person will then have had, in one year, 1/75 to 1/150 of the yearly spontaneous mutations added as roentgen mutations, or for the entire population, 0.13 to 0.26 per thousand. Such addition, even if multiplied tenfold, is of no significance.

The author concludes by saying that today's theory of the damaging effects of roentgen rays on future generations is a hasty generalization based on unfounded conception.—*Salomon Silvera, M.D.*

Meredith, W. J. Dosage distribution and dosage in carcinoma of the uterine cervix. *Radiology*, March, 1950, *54*, 386–391.

The author describes wide type of radium applicators placed about the paracervical triangle so as to get adequate distribution of radiation to the cervical tumor and the commonest paths of lateral extension, simultaneously protecting the rectal and vesicle septa. The dosage is expressed in roentgens. Stages I and II receive only radium therapy while additional roentgen therapy is given to Stages III and IV. The technique and dosage are illustrated by a diagram and several tables. The author gives the five year survivals as 38 per cent.—*E. E. Seedorf, M.D.*

Hall J. Edward, Pepe, John, and Tortora, John. Primary uterine malignancy. *Am. J. Obst. & Gynec.*, March, 1950, *59*, 634–641.

This is a study of 189 cases, 98 cervical in origin and 91 arising in the corpus. The high incidence of corpus lesions as compared to that of cervical malignancies is not adequately explained, as the usual ratio is approximately 3 to 1 in favor of cervical carcinoma.

No one plan of irradiation was followed but rather the treatment was individualized for each patient. In patients with exophytic type of cervical carcinoma, a dose as high as 16,000 r was given by con-

tact therapy at the rate of 4,000 r every ten days. If any additional treatment in the form of radium or deep roentgen therapy was given to this group treated with contact therapy, it was not mentioned in this paper.

Of the available cases of cervical cancer studied, and there were 69 cases, there was a survival rate of 40.8 per cent. There were 62 cases available for five year study in the corpus group and the survival rate was 70 per cent at the end of the five year period. The best results were obtained in the group which had 3,600 mg. hr. radium and complete hysterectomy; the survival rate in this group was 94.1 per cent.—*E. A. Addington, M.D.*

NEWELL, R. R. Human tolerance for large amounts of radiation. *Radiology*, April, 1950, *54*, 598–601.

The author points out that the atomic bomb has made it necessary for responsible military and civilian personnel to prepare for possible radiation injuries. The quantitative tolerance of the human body for gamma rays and neutron rays is the basic aspect of this problem. Very few data are obtainable concerning irradiation of the entire human body. Therefore, an estimate of probable human tolerance to entire body radiation was obtained from scientists working extensively in radiation therapy and radiation biology.

At a meeting of fifty such scientists at the Radiological Society of North America in December, 1948, there were so many divergent opinions that it was impossible to codify the opinion represented. A questionnaire was then prepared, circulated to those present and other experts. Thirty-three replies have been tabulated. The important result from this tabulation was the very wide range exhibited in the answers from the experts. For example, to the question concerning the dose to render 50 per cent of those exposed ineffective, one thought 50 r, 3 thought 1,000 r, and the rest fell in between these extremes. An average of the experts' opinions gives values that are definite, but of doubtful validity.

The author also discusses a number of situations where grave roentgen injuries may be suffered or risked. He points out that heroism must be tempered by judgment in protecting non-expendable personnel from the peculiar nature of radiation injuries, particularly their accumulation. The author concludes that we must be able to measure the radiation fields and give the most precise statements we can about the hazard from such fields. The opinions vary so greatly at this time that it is necessary to obtain some dependable data.—*E. M. Cooper, M.D.*

OVERHOF, KARL, and SIEKMANN, THEODOR. Die röntgentherapeutische Beeinflussung der durch Hypophysentumor bedingten bitemporalen Hemianopsie. (The roentgen therapeutic effect on the bitemporal hemianopsia produced by pituitary tumor.) *Strahlentherapie*, 1950, *81*, 39–62.

The technique for treating pituitary tumors with bitemporal hemianopsia at the Marburg Institute consists of 1,200–2,000 r administered to an occipital, a frontal and each temporal 6 by 8 cm. field in doses of 200 r per day to each of two fields. At the beginning of the treatment, and if any untoward reaction occurs during treatment, the dosage is reduced to 100 r daily. Over a three week period, this yields a 2,500–4,000 r tumor dose.

Contraindications for radiation therapy are rapidly failing vision, acute increase of intracranial pressure and the presence of radiation resistant tumors (cystic or teratomatous tumors).

One hundred cases (7 from the Marburg Institute and the remainder from the European literature) were reviewed. In 79 per cent, radiation therapy materially improved vision; of 17 with amaurosis, 9 regained good vision. Most favorable prognostically were acromegaly, Fröhlich's syndrome and the tumors which produced disturbances in vision without endocrine disturbances—pathologically these are the adenomas.—*H. G. Moehring, M.D.*

MCDONALD, EUGENE J. X-ray treatment in certain nonmalignant conditions. *M. Ann., District of Columbia*, April, 1950, *19*, 199–202.

After a short review of the fluctuations in the therapeutic use of the roentgen rays since their discovery in 1895, the author states that the great advances made during the last ten years in chemotherapy and the massive production of antibiotics have again had their influence in dimming the importance of that branch of roentgen therapy which deals with inflammatory conditions. The purpose of this paper is to call attention to the present trend of reinstating roentgen therapy as the valuable weapon which it was and to justify its usefulness in many of the inflammatory conditions. Brief consideration is also given to its favorable effect on some other conditions, especially myasthenia gravis, localized lymphatic hyperplasia, calcareous tendonitis, verrucae, and keloids.

There are three reasons why roentgen therapy is indicated in inflammatory conditions: (1) no dangerous reactions occur if the treatment is administered competently; (2) no resistant strains of microorganisms are produced, and (3) the method is often successful when other methods have failed. In discussing the mode of action of the roentgen rays in inflammatory lesions the author endorses Desjardins' theory as the most plausible. Clinically, roentgen therapy causes the inflammation to subside or, if given at a later stage, hastens the process of suppuration. There is also a marked analgesic effect.

Of the various inflammatory conditions, roentgen therapy is especially valuable in tuberculous adenitis, chronic lymphoid hyperplasia of the pharynx, subacute and chronic sinusitis, rheumatoid spondylitis, subacute thyroiditis and certain inflammatory skin lesions. The author considers these entities one by one and lays emphasis on the various practical points. Some of the pertinent data revealed are: streptomycin and other antibiotics have not produced the results hoped for in tuberculous adenitis, so that the early enthusiasm is ebbing; local radon applied against the eustachian tubes in chronic lymphoid hyperplasia must be used with caution; roentgen therapy, if given for a similar purpose, although not as well defined as radon therapy, can be directed to the entire nasopharynx, and if necessary to the oropharynx; roentgen therapy is beneficial in a large percentage of cases of subacute and chronic sinusitis but should not be used in acute and atrophic sinusitis; in rheumatoid spondylitis at least 75 per cent of the cases show marked symptomatic relief, and 50 per cent develop objective improvement, but if ankylosis has occurred and the joints are rigid, no change can be expected; subacute thyroiditis may completely clear up following three or four roentgen treatments given every other day; of the skin conditions, acne should be irradiated only when associated with deep-seated scarring and induration.

In discussing the value of the roentgen therapy in the other benign lesions mentioned above, the author brings out the following facts: myasthenia gravis usually responds to four or five treatments over the thymic area, but if a mass is visible on the roentgenogram this should be removed first; in acute calcareous tendonitis the response to a single roentgen exposure can be dramatic but in the chronic stages, especially if restricted mobility is present, it is much slower; warts are treated only if the condition cannot be attributed to or cured by orthopedic means; old keloids are excised first, the skin carefully approximated and roentgen therapy is started within twenty-four hours of the operative procedure.

In concluding, the author expresses the hope that the scope of roentgen therapy will be extended to include also the more recalcitrant cases. "Judiciously used it will do no harm in the cases in which there is no benefit."—*T. Leucutia, M.D.*

Jentzer, A. Traitement du cancer de la langue. (Treatment of cancer of the tongue.) *Schweiz. med. Wchnschr.*, April 29, 1950, *80*, 429–432.

A thorough elimination of septic foci precedes all operative procedures in cancer of the tongue. Decayed teeth are extracted.

No results are obtained in cancer of the base of the tongue due to technical difficulties and to the importance of the lymphatic drainage of the area. However, cancer of the anterior portion of the tongue will respond favorably to gamma therapy and to surgery. In the author's experience, cancer of the frenulum is primarily the surgeon's responsibility.

The author's technique consists of an excision of the tumor by means of electrocoagulation and gland dissection. It is not specified whether local or bloc gland dissection is carried out. In cases of cancer of the floor of the mouth and frenulum, the mandible is not resected, but split at the symphysis to facilitate proper eradication of the diseased parts. This is immediately followed by a belt implantation of the tumor area with radon seeds spaced 1 cm. apart and filtered by 0.3 mm. Au. The amount of radon varies from 7 to 14 mc. A dose of 3,000 gamma r is delivered. The low filtration allows beta rays to 3 mm. around the seeds. The radon implantation is done to destroy cancerous cells which may be left behind by surgery.

Two or three weeks later, a radium mold is applied to the lymph node area, a dose of 4,800 gamma r being delivered to the skin with an equivalent filtration of 1 mm Pt.

Seven cases are discussed. There are no general statistics. Cures vary from three to twenty-four years. Photographs are shown and the results are somewhat unsightly but may be justified if long term survival is obtained.—*Jean-Pierre Jean, M.D.*

Cutler, Max. Radiotherapy of early cancer of the larynx; five year results in one hundred and fifty-six cases. *J.A.M.A.*, April 1, 1950, *142*, 957–963.

Cutler reports his results in a series of 156 consecutive cases of cancer of the larynx, treated by roentgen therapy and observed for a minimum of five years. He used the "concentration" technique (the administration of a large total dose in a relatively short period of time and the use of an increasing dose through a diminishing portal) first described by him in 1941 and since adopted by many therapists. Lymph node metastases outside the laryngeal portals received additional irradiation.

Of 98 patients with advanced disease in whom the cords were completely fixed and in many cases accompanied by regional lymph node metastases, 18 are living and apparently free of disease more than five years after treatment—an 18 per cent five year "cure" rate.

Of 58 patients with movable or partly fixed cord lesions, 37 were free of disease more than five years after treatment. An additional 6 of the 58 died in less than five years from cause other than cancer and without recurrence, giving a 71 per cent five year "cure" rate.

Looking at the same 156 cases in relation to operability, of 87 extrinsic, inoperable cases, 3 died in less than five years from causes other than cancer and without recurrence, 15 are living and free of disease more than five years after treatment—an 18 per cent five year "cure" rate.

Of 48 patients with lesions too advanced for laryngofissure and suitable for laryngectomy, 4 died without recurrence in less than five years, 25 are apparently cured for more than five years—a 57 per cent curability.

Of 21 patients with lesions amenable to laryngofissure, 1 died without recurrence in less than five years, 15 are apparently cured—a 75 per cent curability.

In view of these figures, which bear out previous reports, the decision as to whether, in operable cases, to elect surgery or irradiation becomes difficult. In general, roentgen therapy is the treatment of choice when the cords are freely movable or only partly fixed. Total laryngectomy is best reserved for advanced lesions with completely fixed cords occurring in surgical subjects with a good life expectancy, providing the fixation is due to cancer rather than infection of biopsy trauma.—*George Cooper, Jr., M.D.*

BERKMAN, A. TEVFIK. Postoperative radiotherapy of breast cancers. *Radiology*, April, 1950, *54*, 572–575.

The author discusses 654 patients sent by various clinics to the Istanbul Institute for treatment of postoperative breast cancer between 1936 and 1946. Of this series 343 were referred for treatment of recurrent or metastatic growths, as compared to 303 receiving postoperative radiation therapy. Eight of the cases were males and are not considered in this paper.

Irradiation of the 343 cases for recurrence or metastasis is not to be considered as postoperative treatment. In 209 patients of this group, local irradiation was given, and in 53, irradiation castration only was given. There was a two year recovery rate of about 27 per cent of those completing treatment.

Of the 303 patients receiving prophylactic postoperative treatment, 116 were treated in the third or fourth week, 131 in the sixth to eighth week, and 56 after an interval of three months or longer. Relapses and metastases were observed in 52 of the 269 patients followed, or about 19 per cent. When compared with the incidence of relapses and metastases in cases treated by operation only (52 per cent of the series referred to the author, and 73 per cent of the series reported by Creyssel and Morel) the importance of postoperative irradiation is striking.

The author advocates the routine use of postoperative irradiation of mammary cancer because he is convinced of its value by the results which he has obtained.—*E. M. Cooper, M.D.*

GUTTMANN, RUTH J. X-ray therapy of primary inoperable carcinoma of the breast. *Radiology*, April, 1950, *54*, 567–571.

The 82 cases discussed by the author meet the following requirements: (1) The diagnosis had to be "primary inoperable carcinoma of the breast." (2) The diagnosis had to be proved by biopsy. (3) The follow-up had to be complete. (4) The patient must not have received any treatment, but roentgen therapy, and the technique must have been essentially the same in all treatments.

As many portals as possible were used in order to cover the involved region with a wide margin of safety. The treatments followed a similar pattern. The breasts were built up with sand bags in order to protect lung tissue. The factors for the axillary and mammary portals were: 250 kv., 1.5 mm. Cu, 50 cm. target-skin distance. The daily dose to any field was 250 r, measured in air, using a 14 by 10 cm. field. The total dosage, depending on skin tolerance, varied from 2,500 to 3,000 r (in air) per field. The tumor dose varied between 3,000 and 4,000 r at the center.

Treatments to the chest wall were given by low voltage: 120 kv., 3 mm. Al, and 30 cm. target-skin distance. The single exposure was 400 r (in air), the total dosage to each field 2,400 to 2,800 r. The course of treatments lasted between four and eight weeks, the irradiation being well tolerated. The usual skin changes were encountered and some patients complained of shortness of breath on exertion. The latter usually subsided in ten to twelve months.

Of the 82 patients treated, 15 died during the first year; 7 of the remaining 67 patients have been treated since 1947, which leaves 60 patients for further consideration. The author found that it was impossible to evaluate the facts and findings of these patients with a view toward determining who will respond to therapy and who will not. The type of tumor, whether relatively benign and slow growing or very malignant, was of little importance as far as progress and outcome were concerned. There were 10 patients without evidence of disease two years after treatment, 9 after three years, 4 each after five, six, and seven years, and 2 patients after eight years.

The author emphasizes that these patients should not be denied treatment "because they are beyond any help." Roentgen treatment has improved the condition of many patients and has sometimes even led to restoration to a normal life.—*E. M. Cooper, M.D.*

BRACHETTO-BRIAN, DOMINGO. Bases para el tratamiento integral del cáncer de la mama. (Bases for the integral treatment of cancer of the breast.) *Prensa méd. argent.*, May 5, 1950, *37*, 921–924.

This is a preliminary communication embodying the underlying principles of the plan which has been adopted by the Section of Mammary Pathology of the Institute of Experimental Medicine at the University of Buenos Aires for the treatment of cancer of the breast.

Formerly attention was paid only to the cancer

and its metastases by considering the neoplastic process as being completely isolated from the rest of the organism. The treatment consisted of surgery and roentgen therapy. In 1947 a new plan was introduced. Based on the more recent results of the numerous experimental investigations the fundamental systemic disorders were also analyzed and an attempt was made to correct them although the treatment of the cancer itself continued to remain an essentially surgical problem.

It is now generally accepted that in animals three factors are responsible for the production of cancer of the breast: (1) the genetic constitution of the individual, which is equivalent to the "chromosomal or mendelian factor"; (2) the hormonal stimulus; and (3) the Bittner agent transmitted through the mother's milk. These two latter are also called "extrachromosomal or non-mendelian factors." In the human, only two factors are of practical importance: (1) the genetic constitution and (2) the hormonal stimulus.

(1) *The genetic constitution.* This factor could only be evaluated in homozygous families which under our civilization is an impossibility. Considerable information can be gained, however, from a study of the "susceptibility" of the mammary tissue to the influence of the hormonal stimuli. Unequal development of the two breasts during puberty, uneven premenstrual swelling leading to aplasia or hypertrophy of one of the breasts during sexual life, and differences in the size of the breasts during menopause may be considered as varying morphologic or functional responses of the mammary tissues to the same activating agent, thus representing a variation in "susceptibility."

(2) *The hormonal stimulus.* There is no doubt that estrogenic substances play a major role in the causation of cancer of the breast in women. To estimate the estrogenic balance the curve of the vaginal cytology was determined routinely. A curve characteristic of hyperestrogenic function was found in 90.2 per cent of the patients between thirty and forty years of age, 50 per cent between fifty and fifty-five years and 20 per cent between fifty-five and sixty-five years. This procedure was found to be of incalculable importance in directing the hormonal therapy.

The antiestrogenic action is obtained: (a) by suppressing the source of the estrogens (oophorectomy), or (b) by the administration of the opposite hormone, i.e., testosterone.

Basic treatment. Routine oophorectomy is recommended in all cases of cancer of the breast with an elevated estrogenic curve of the vaginal cytology. This is done at the time of the mastectomy if a simple Halsted operation is performed or prior to the mastectomy if an extended Halsted operation becomes necessary. Experience shows that the basal cells of the vaginal smear completely disappear within fifteen days after the oophorectomy but reappear ninety days later, indicating that at this time extraovarian estrogens are set in motion. Cornified cells, at the rate of 1 to 4 cells per field, are found within one year after oophorectomy in 20 per cent of the women. For this reason, the administration of male hormones is started three months after oophorectomy and if there was an unfavorable response even sooner. For practical and economic reasons one may resort to subcutaneous implantation of 100 mg. testosterone pellets for a total dose of 500 mg. A more effective procedure is the intramuscular injection of testosterone propionate in daily doses of 50 mg. until a total dose of 6,000 mg. or more has been reached.

Palliative treatment. Hormonal therapy is used in all acute and advanced primary cancers of the breast, as well as in the metastatic disseminations. In the acute and ulcerated cases 30 per cent show a temporary palliation, one-third of which are transformed into operable cases.

Complementary treatment. In view of the fact that a large part of the hormones is inactivated in the liver by being transformed into metahormones, the increased estrogenic level may be the result of a lowered threshold of inactivation due to various hepatic disorders. Therefore, a clinical and functional examination of the liver as well as immediate treatment of its disorders is recommended in all cases of cancer of the breast.

Vitamin B complex, choline and methionine serve to inactivate the estrogens and androgens in the liver. The author considers a daily dose of 1 gm. of methionine as the optimal dose.

Operation. The simple Halsted or extended Halsted operation is used. In this latter, the clavicle is lifted, and the mammary axillary, infraclavicular and supraclavicular regions are transformed into a single operative field.

By following the above described plan, more than 500 cases were treated from 1947 to 1949. The author wishes to wait for the five-year follow up period before presenting the statistical results.—*T. Leucutia, M.D.*

Meyer-Laack, Helmut. Über das Sudecksche Syndrom und seine röntgentherapeutische Heilung. (On Sudeck's syndrome and its cure by roentgen therapy.) *Strahlentherapie*, 1950, *82*, 231–246.

Although Sudeck first described the entity bearing his name forty years ago, it was not until 1936 and 1938 that Rieder and Sudeck also studied the histopathologic alterations of the process.

Based on these alterations, three stages may be distinguished in the development of the syndrome: (1) From the very beginning there is pronounced hyperemia of all blood vessels of the bone and periosteum inducing a proliferation of the tissue elements of the periosteum, of the connective tissue of the haversian canals and of the reticulum of the bone marrow. This leads to absorption as well as osteo-

clastic destruction of the bone with marked widening of the haversian canals and extensive atrophy of the matrix. Soon a tendency to form osteogenic tissue appears but due to poor recalcification only osteoid tissue is deposited. (2) After two or three months the process either assumes a course toward healing or more often is transformed, owing to severe crisis in the regenerative capacity, into a "dystrophy" which is the essential feature of stage 2. Histologically at this time there is a marked narrowing of the trabeculae of the spongiosa and a thinning of the cortex. Only scattered islands of new bone formation are seen; the osteoclasts and osteoblasts are unidentifiable; and the microscopic picture is dominated by numerous enlarged capillaries which, in a state of complete stasis, surround the bone trabeculae and apparently destroy the newly formed osteogenic tissue. From this stage healing hardly ever occurs but the process continues to advance. (3) The third stage is characterized by a reaction-free "atrophy." The marrow spaces are wide and the bone trabeculae are small, without the presence of osteoblasts or osteoclasts.

It is an important observation that the alterations are not confined to the osseous structures alone but also extend to the neighboring soft tissues. The joints and their capsules are gradually destroyed leading to fibrous ankylosis. Likewise, the fat in the subcutaneous tissues is replaced by fibrous proliferation and sclerosis. Even the skin and, in the very advanced cases, the muscles become atrophic.

The roentgenographic examination usually elicits no significant findings in the first stage of the syndrome. Only in a small percentage of the cases (when the calcium loss exceeds 15 per cent) is there evidence of a slight rarefaction, which occurs in the metaphysis and epiphysis before extending to the diaphysis. In the second stage there is a definitely mottled appearance of the affected bone due to an admixture of granulation tissue, newly formed osteoid tissue and partially destroyed bone trabeculae. Later diffuse atrophy is noted. The translucent zones near the borders of the bone not infrequently give the impression of erasures by india rubber and the contours appear as if they were enforced by lead pencil. In the third stage the structure of the bone is barely visible.

The etiology of Sudeck's syndrome is not completely clarified. In the beginning there is a nonspecific reaction of the tissues which may be provoked by various agents such as trauma, inflammation, neuritis, thrombosis, frost-bite or burns. Sudeck and Rieder assumed that the colloidal disturbances brought about by the disorganization of the cells lead through a local effect on the sympathetic nerves to narrowing of the arterioles with secondary peristatic hyperemia of the corresponding afferent region. The author, however, believes that the condition constitutes a reflex functional disorder, provoked by persistent irritation of all the sympathetic fibers concerned and that thus the effect is more general in nature.

Maurer estimated that by applying conventional orthopedic measures the period of healing in Sudeck's syndrome of first stage extends to forty-eight weeks in men and fifty-four weeks in women. In the more severe cases two or three years may elapse before a cure is accomplished.

The author reports 3 patients in whom the course of the disease was shortened by months or years by the administration of roentgen therapy. Although no rigid technique is recommended, the good results were obtained with the following average procedure: In lower extremities the irradiation was applied to the site of the lesion, the politial fossa, Scarpa's triangle and the homolateral paramedial lumbosacral region; in the upper extremities it included the site of the lesion, the inner aspect of the forearm, the axilla and homolateral paramedial cervicothoracic region. The factors used were 180 kv., 0.3 mm. Cu, 8 by 10 cm. fields and 40 cm. skin-target distance. The individual dose amounted to 120 r on all fields, except the site of the lesion where it was increased to 150 r; 3–4 similar doses given within four to six days constituted a series. In case of necessity the series was repeated, as a rule, only over the site of the lesion, three months later. At this time the individual dose was raised to 200 r and was administered again four times during an identical period.

In concluding, the author expresses the opinion that roentgen therapy constitutes the method of choice in all stages of Sudeck's syndrome. Orthopedic measures are indicated only in the cases in which irradiation failed to bring about an absolute cure.—*T. Leucutia, M.D.*

Naumann, W., and Frank, A. Kritisches zur Röntgenbestrahlung des Magengeschwürs. (Critical study of roentgen irradiation of gastric ulcer.) *Strahlentherapie*, 1950, *82*, 223–230.

A review of the literature reveals some 70 articles stressing the value of roentgen therapy in ulcer of the stomach and duodenum. Nemenow and Jugenburg, for example, reported a series of 635 patients afflicted with ulcer of whom roentgen irradiation cured 308, improved 262, and only 67 remained uninfluenced. Other investigators failed to secure such favorable results.

During the last few years the problem again has created considerable interest and especially Hedfeld has found the procedure so useful that he now recommends roentgen therapy as the method of choice in all types of ulcer, the range of indication extending from the fresh ulcus simplex to the advanced callous form. Even the bleeding ulcer and the ulcus pepticum jejuni, which Lenk formerly considered as radioresistant, are subjected to irradiation, and Breitländer

insists that in gross hemorrhages threatening the life of the patient a cessation of the bleeding can be brought about within a few hours, or one to two days at the longest.

The favorable effect of the roentgen rays is generally attributed to the action on the altered vegetative nervous system although the concomitant biologic processes are too complex to be fully elucidated.

Stimulated by the great preponderance of positive reports, the authors undertook a critical study of the value of roentgen therapy in chronic gastric ulcer. Ten male patients were selected, in whom the ulcer had persisted for a number of years and who had had at least one or several unsuccessful courses of dietary treatment. The subjective symptoms were very pronounced in all cases and a few patients had a history of recurrent gross hemorrhages. The ulcers with penetration into the neighboring organs and the fresh ulcers with recent onset were not included in the study.

Roentgenologic examination prior to the institution of treatment revealed the presence of a callous ulcer in every instance. The niche varied from a split pea size to that of a navy bean.

Eight patients were hospitalized during the irradiation and 2 were treated in an ambulatory way. No special diets were observed and no medicaments were given.

The roentgen therapy was carried out with 180 kv., 0.5 mm. Cu, 4 ma., at 50 cm. focus-skin distance. A single field, 10 by 15 cm. in size, including the region of the stomach and celiac plexus, was used. A dose of 90 r was administered every third day for a total of 6 to 8 treatments. Nausea was never observed and all patients supported the treatment well.

A checkup roentgenologic examination, usually associated with gastroscopic study, was performed within three to four weeks after completion of the roentgen irradiation.

The following results were obtained: There was no definite and permanent healing of the ulcer niche and accompanying gastritis in a single case. The effect on the pain was likewise irregular; a complete asymptomatic state lasting for a longer time was never reached. The hyperacidity, however, sank to normal in every instance.—*T. Leucutia, M.D.*

Rodé, Iván. Versuche zur Beeinflussung der Leukämien mit in vitro röntgenbestrahltem Blute. (Attempts to influence the leukemias with blood irradiated *in vitro*.) *Strahlentherapie*, 1950, *81*, 107–116.

Blood irradiated in vitro has no therapeutic value in leukemia since its effect is only transitory. The subjective effect is good; the course of the disease and the length of life are unaffected.—*H. G. Moehring, M.D.*

Levi, Leo M., and Engle, Robert B. Radiation therapy of acute pancreatitis; report of twenty-eight cases. *Radiology*, April, 1950, *54*, 576–578.

The fact that surgical parotitis often responds favorably to roentgen therapy suggested the treatment of acute pancreatitis by irradiation. A total of 28 patients were treated from 1941 to 1948. Any patient referred with a reasonably substantiated diagnosis was accepted for treatment.

The majority of the patients were treated through a 15 by 15 cm. anterior epigastric port, using 75 r (measured in air) on two successive days with roentgen rays generated at 140 kv., with 0.25 mm. Cu and 1 mm. Al inherent filtration, 5 ma., 20 cm. target-skin distance, and a half-value layer or 0.46 mm. Cu.

There were 2 deaths. One of these died of multiple gastrointestinal fistulas; the second died of delirium tremens six months after treatment. It was found that there was no response to treatment in terms of fever or of diastatic activity of blood or urine, recurrences were not averted, and that sequelae (pancreatic cysts in 2 patients) were not averted. There appeared to be definite clinical improvement following radiation therapy in that the patients obtained relief from nausea and distention, and often of pain. This response varied from a few hours to days.—*E. M. Cooper, M.D.*

Cocchi, Umberto. Die Therapie des grobfollikulären Lymphoblastoms (Brill-Symmersche Erkrankung). (The therapy of macrofollicular lymphoblastoma [Brill-Symmers disease].) *Schweiz. med. Wchnschr.*, April 29, 1950, *80*, 440–442.

The author reports the therapeutic results in 94 cases of macrofollicular lymphoblastoma, a malignant tumor which leads if not treated to generalization and death within two to three years. The lesion can be treated by surgery, roentgen irradiation and chemotherapy, or a combination of several of these agents.

Surgery is possible in those cases only in which the manifestation of the disease is confined to the spleen or to a group of solitary lymph nodes. Thirty per cent of those treated by surgery alone and 20 per cent of those treated by a combination of surgery and irradiation were free of disease after five years.

When roentgen therapy alone is used, a dose of 400 r is sufficient to bring about complete regression. Recurrence, however, is frequent and independent of the dosage. The radiosensitivity diminishes following repeated exposure. The author recommends, therefore, higher doses for the initial irradiation. Of the cases treated with roentgen therapy alone, 18.3 per cent were free of disease after five years.

Insufficient data are available to evaluate the results of chemotherapy.

The treatment of choice remains radiation therapy.—*H. P. Mueller, M.D.*

Szellö, F. X-ray treatment of perineal inflammation in the puerperium. *J. Obst. & Gynaec. Brit. Emp.*, April, 1950, *57*, 246–247.

The efficacy of roentgen treatment in acute mastitis in obstetrical clinics suggested its use in other superficial inflammatory processes and was therefore applied in cases of acute perineal infiltration following spontaneous rupture or episiotomy. The technique used was 80–100 kv., 10 ma., 3 mm. of aluminum, 30 cm. skin-target distance, 60–100 r to the skin per dose. Irradiation was directed so that the ovaries remained completely outside the range of the direct rays. Smaller doses were used if the cases showed rapid extension of the inflammatory process since larger doses may, instead of inducing and accelerating absorption of the infiltration, lead to suppuration and inhibit demarcation. In most instances only one treatment was required, but in the others a second irradiation was necessary. Prompt alleviation of symptoms and healing by primary union without evidence of secondary infection was the rule and hospital stay was no longer than in the uncomplicated cases.—*R. K. Arbuckle, M.D.*

Ceelen, W. Über Röntgenschäden des Darmes. (On roentgen injuries of the intestine.) *Strahlentherapie*, 1950, *82*, 13–22.

After a brief review of the literature on damage of the intestine by excessive roentgen irradiation, the author presents 2 cases of his own, both with fatal outcome.

The histologic examination revealed no changes which could be considered as pathognomonic for roentgen injury, thus confirming the observations of former investigators. In the first case the macroscopic appearance was that of a pseudomembranous enteritis resembling dysentery, with several deep ulcerations. In the second case a markedly thickened intestinal loop with gangrenous necrosis and a penetrating ulcer was found at operation, leading to death by peritonitis. The total dose in the first case, which was that of an osteosarcoma of the pelvic girdle, amounted to 5,000 r, given with deep roentgen rays through three fields over a period of forty-nine days. The patient died eight days after the completion of the series. The amount of radiation administered in the second case could not be ascertained since the treatment was carried out at another institution. This patient had several series of deep roentgen therapy for a carcinoma of the cervix, two of which were given postoperatively following a radical Wertheim operation and three series nearly two years later for recurrence. She died four months after the last series of irradiation. The postmortem findings and especially the results of the histopathologic investigations are described in detail.

The conclusion is reached that the roentgen injury of the intestine does not manifest itself in the form of a corrosive action. The effect occurs primarily on the vessels and connective tissue through damage of the endothelial and histocytic cells. A marked dilatation of the vessels develops with abnormal permeability of the walls, serofibrinous exudate and clotting of the tissue fluids and plasma. At this stage the intestinal epithelium, which is very sensitive to circulatory disturbances, undergoes necrosis leading to surface defects with pseudomembranous coating of the intestine. The persistence of the impaired blood and lymph flow finally results in deep-seated ulceration of the intestinal wall. It is impossible to estimate on the basis of the microscopic study the relative parts played in this destructive process by the direct action of the roentgen rays, the secondary infection from intestinal bacteria and the irritation from fecal matter. The action of the roentgen rays themselves depends on a multiplicity of factors, including the type and state of the irradiated tissue and above all the mode, dose and technique of the irradiation.—*T. Leucutia, M.D.*

RADIOISOTOPES

Govaerts, J. Rate of elimination of C^{14} administered as $BaC^{14}O_3$. *Science*, April 28, 1950, *111*, 467–469.

In order to evaluate the hazard of inhaling long lived radiocarbon C^{14} in laboratory workers, the author studied the rate of elimination of $BaC^{14}O_3$ in mice.

The inhalation of the material by the mice presented experimental difficulties. For this reason intravenous injections of a fine suspension of $BaC^{14}O_3$ in isotonic glucose were given in order to deposit the barium carbonate in the lungs of the mice. Most of the injected suspension is deposited in the lungs.

The mice are then isolated and the exhaled CO_2 is fixed and collected and the inhaled air is made free of CO_2 by passing it through soda lime. The excreta are collected and the animals sacrificed.

The data indicate that the excretion of the injected C^{14} by the lungs is very rapid particularly in the first four hours. After twelve hours about 85 per cent of the dose is excreted as $C^{14}O_2$. No significant activity was found in the organs or excreta. By plotting the data on semilog paper biological half-lives may be obtained.

Similar results were obtained by the intravenous administration of sodium carbonate containing C^{14}. The author concludes that most of the C^{14} absorbed by the organism as barium carbonate is expired by the lungs as $C^{14}O_2$ and that the dangers to laboratory workers are not as great as expected.—*R. A. Hays, M.D.*

Hertz, Saul, Whitham, Glenn E., MacLeod, Allan, Hanopol, Louis, and Miller, Arthur. An analysis of multiple counter technique for the measurement of radioac-

tive sources independent of geometry. *Science*, May 26, 1950, *111*, 576–578.

This paper presents a theoretical analysis of the measurement of radiation from a point source within an area bounded by four Geiger-Müller counters. The purpose of this counter arrangement is to define area limitations in which counting rates of a desired accuracy may be obtained independent of the geometric placement of the radioactive source in that area.

Curves showing the variation of counting rate with changes of placement of the point source are plotted. These curves show that the counting rates obtained with a placement of the source anywhere within a circle of radius one-fifth of the radius of the circle on which the counters are mounted exceeds by no more than 5 per cent the counting rate obtained with the source in the exact center of the circle.

This latter prediction was checked experimentally by an assembly of four Geiger-Müller counters with satisfactory results. The experimental data have been plotted and show reasonable agreement with the normal error curve.

This apparatus is to be used for measurements of radiation dosage on patients (presumably for radioiodine in the thyroid), and is expected by the authors to give results with an error of only a few per cent. —*H. L. Friedell, M.D.*

Feitelberg, Sergei, Kaunitz, Paul S., Silver, Solomon, Simon, Norman, Wasserman, Louis R., and Yohalem, Stephen Bennett. Hyperthyroidism; treatment with radioactive iodine. *Arch. Int. Med.*, March, 1950, *85*, 471–478.

The authors give the results of treatment of 184 cases of hyperthyroidism, followed from three to thirty months. One hundred and fifty of the patients had diffuse toxic goiters. Twenty-eight adenomas were treated where there were cardiac and other complications. The radioactive iodine used was standardized on the basis of the "New York" millicurie. This millicurie is equivalent to 0.67 of the Oak Ridge millicurie. The single dose method of treatment was used. A dose of I^{131} which would deliver approximately 10,000 roentgen equivalents to the gland was considered adequate. The average dose of I^{131} was 8.2 millicuries. The average retained dose per gram of gland was 80 microcuries. One hundred and thirty-two patients were controlled on a single dose, 43 required a second dose, and 9 required a third dose.

Failure to respond to the initial dose was thought to be due to several factors: (1) errors in estimation of gland weight; (2) variations in biological half-life; (3) non-uniformity of distribution of I^{131} within the gland, and (4) variation in sensitivity of gland to radiation.

One hundred and eighty-two of the 184 were cured with I^{131}. Of these 13 (7 per cent) developed hypothyroidism. The authors consider I^{131} the treatment of choice in diffuse toxic goiter.—*H. L. Friedell, M.D.*

Meites, Joseph, and Wolterink, L. F. Uptake of radioactive iodine by the thyroids of underfed rats. *Science*, Feb. 17, 1950, *111*, 175–176.

Activity of the thyroid gland as measured by uptake of radioactive iodine (I^{131}) was studied in rats which had been underfed to various degrees. Body weight and thyroid weight were found to decrease in proportion to the degree of starvation. The uptake of I^{131} also decreased in proportion to the degree of underfeeding but radioactivity per milligram of thyroid tissue and per 100 grams of body weight remained constant in all groups. These data support the conclusions that underfeeding reduces thyroid activity and that the reduction in activity is directly proportional to reduction in body weight.—*R. Emerick, M.D.*

Friedell, Morris T., Indeck, Walter, and Schaffner, Fenton. Radioactive isotopes in the study of peripheral vascular disease. III. Further studies on the circulation index with an evaluation of the diagnostic and therapeutic value of priscoline®. *Arch. Int. Med.*, April, 1950, *85*, 667–674.

In studying the status of the peripheral vascular circulation by the use of radioactive phosphorus, the authors have established a circulatory index. This is the reciprocal of the slope of the line which results from plotting on semilog paper the counts per minute against the time as the logarithmic function. The counts are obtained at the sole of the foot following the intravenous injection of 200 microcuries of P^{32}.

The index for normal individuals is above 0.110 with an average of 0.160. In arteriosclerotic legs the average is 0.089. This index can be altered by subjecting the patient to treatment which produces vasodilatation.

The response of the circulatory index to treatment falls into four groups. In Group I the CI is initially in the arteriosclerotic range and rises to normal after therapy. In Group II the index is low and falls lower with treatment. The responses in Group III are complex and the cases are subdivided into (a) patients with an initial index above 0.110 but not up to mean normal range which shows a fall into the arteriosclerotic range after treatment, and (b) those with an initial range above 0.110 which rises above normal. In Group IV the index is above the normal range and rises even higher after treatment.

These clinical groups are of value in predicting which patients will respond favorably to therapy. Prognosis has been shown to be more favorable in Group I and poorer in the subsequent groupings.

Priscoline was the drug investigated in this re-

port. Its action is complex causing peripheral vasodilatation and increased cardiac output. It constitutes a satisfactory drug for the determination of the above groupings. Its advantages over lumbar block and tetraethylammonium chloride as an out-patient procedure are obvious. It is apparently more effective in those conditions in which the symptoms are due to diminished blood supply than in causalgic states.—*R. A. Hays, M.D.*

OVERMAN, WILLIAM J., GORDON, WILLIAM H., JR., and BURCH, G. E. Tracer studies of the urinary excretion of radioactive mercury following oral administration of a mercurial diuretic. *Circulation*, April, 1950, *1*, 496–501.

The absorption, blood concentration and urinary excretion of an orally administered mercurial diuretic (mercuhydrin) were studied in 22 control subjects and 5 patients with congestive heart failure by means of radioactive mercury 203 and 205.

The material was put up in capsules so that each capsule was equivalent in mercury content to 0.5 cc. of the intravenous mercurial diuretics. Some of the capsules were made of plain gelatin and others were enteric coated by means of shellac and salol.

The total urinary excretion of mercury following the oral administration of the diuretic was low. The average recovery was 3.8 per cent of the administered dosage. The urine of the patients receiving the plain gelatin capsules demonstrated the highest percentage recovery, indicating that most of the mercury is absorbed in the upper gastrointestinal tract. The plasma content of mercury after oral administration is low compared with the parenterally administered drug. There was no significant difference in the plasma content between the controls and the congestive heart failure patients.

Studies of the stools demonstrated that large amounts of the mercury pass through the gastrointestinal tract without being absorbed. It is not reexcreted in the stool.

The authors believe that, since the degree of diuresis is proportional to the amount of mercury excreted in the urine, large doses must be given by mouth to produce the equivalent urinary excretion of an inravenously administered dose. This would necessitate about 12 capsules which, in most instances, would produce toxic reactions. The study would seem to preclude the general use of oral mercurial diuretics in congestive heart failure.—*R. A. Hays, M.D.*

BENJAMIN, JOHN A., NEUMAN, WILLIAM F., THOMPSON, HERBERT E., and WATERHOUSE, CHRISTINE. Radioactive phosphorus (P^{32}) used to study phosphate exchange between urine in the renal pelvis and renal calculi containing phosphate. *Science*, May 5, 1950, *111*, 498–499.

The phosphate exchange between urine in the renal pelvis and renal calculi containing phosphate was studied in one patient with a normal patient as a control. A tracer dose of P^{32} was given to each patient. Urine samples were collected from both kidneys in each case by means of ureteral catheters. The activity of the various samples was then plotted against time over a twelve hour period. The P^{32} level of the urine from the kidney containing the calculi reached its peak more slowly, and the peak was not as high as that for the urine from the normal kidney in the same patient. However, the P^{32} excreted from the affected kidney remained elevated for a longer time. In the control patient, no difference in urine specific activity could be detected from either kidney.

The authors explain the difference in specific activity in the patient with calculi by the phenomenon of ion exchange. When the P^{32} content of the urine is high, P^{32} as phosphate from the urine exchanges ionically with the phosphate of the calculi. This would lower the specific activity of the urine. Hours later, when the radioactive phosphate of the urine is lower than that of the calculi, exchange of the non-isotopic phosphate with the urine phosphate of the calculi occurs. Thus the activity of the urine is sustained on the affected side. Assay of the calculi removed at surgery showed them to contain P^{32}, verifying the ionic exchange theory.—*H. L. Friedell, M.D.*

MULLER, J. H. Premiers résultats thérapeutiques, obtenus à l'aide de la radioactivité artificielle, démonstration. (First therapeutic results obtained by means of artificial radioactivity; a demonstration.) *Schweiz. med. Wchnschr.*, April 29, 1950, *80*, 437–438.

This article deals with early results obtained by the use of isotopes but is more an outline of techniques than of results. Radioactive isotopes are seldom used in a nonspecific way as in the case of radioactive sodium which diffuses through all body fluids and irradiates the whole body.

In most instances a more specific action is desired. Various means of conveying radiation are suggested: (1) ***through metabolic affinities:*** P^{32} and I^{131} are used much in the same manner as in the United States and applied to the same conditions; (2) ***by proper used of the chemical state and molecular properties of the radioactive substance:*** colloidal Zn mixed with pectine has been successfully injected intraperitonealy in cases of generalized peritoneal metastases from ovarian carcinoma. One hopeless case has survived three years. Colloidal radioactive gold has also been used with consecutive decrease or disappearance of ascites in several cases. Colloidal gold may also be injected into tumors. No radioactivity has been detected elsewhere in the body following such injections; (3) ***isotopes may be used locally by means of simple apparatus:*** some isotopes may be used in place of ra-

dium; furthermore, some of them may be used in liquid state. Radioactive cobalt, for example, has been successfully applied as a solution placed in rubber containers in small body cavities such as the urinary bladder, the rectosigmoid after colostomy and the uterine cavity.—*Jean-Pierre Jean, M.D.*

CHEMOTHERAPY

Taylor, S., Hass, G., Crumrine, J., and Slaughter, D. Toxic reactions of 4-aminopteroylglutamic acid (aminopterin) in patients with far-advanced neoplastic disease. *Cancer*, May, 1950, *3*, 493–503.

The authors treated 18 patients with extensive metastatic malignancies with 0.1 mg. of aminopterin (usual dose 0.2 mg.) daily and observed that the drug was not as well tolerated in their cases as in the leukemic patients who are often given 0.5 mg. daily. Aminopterin failed to halt tumor growth and had the following toxic effects: glossitis, stomatitis, vaginitis, proctitis, vesicular dermatitis, alopecia, pancytopenia, palasia of the bone marrow, and ulcerative colitis with a bloody diarrhea. Two out of the 18 patients died directly from the effect of the aminopterin. Complete autopsy findings are evaluated in 15 of the 16 patients who died.—*E. H. Price, M.D.*

Caby, F., and Tsevrenis, H.: Traitement d'un lymphosarcome du cou par l'association du nitrogène-moutarde, de la radiothérapie et de la chirurgie. (Treatment of a case of lymphosarcoma of the neck by a combination of nitrogen mustard, roentgen therapy and surgery.) *Presse méd.*, April 15, 1950, *58*, 410–411.

A case of primary lymphosarcoma with very malignant characteristics developing on the right side of the neck is described. Biopsy was performed and the diagnosis established on the twenty-first day following onset of the right-sided glandular enlargement. In their comments on the case the authors state: (1) there was a high sensitivity of the primary lesion to the application of nitrogen mustard, (2) nitrogen mustard and roentgen therapy did not check the extension of the sarcoma on the right side of the neck (nodes decreased rapidly but extension occurred along right cervical lymphatics) but since no glands enlarged on the left side it is believed this treatment prevented involvement of the lymph nodes on the left. Surgical excision of the right-sided mass and lymph nodes above the right clavicle was finally resorted to. The patient's life was prolonged seven months by the treatment used in this case of a particularly malignant and rapidly growing cancer. —*W. M. Loehr, M.D.*

MISCELLANEOUS

Levene, George, and Bragg, Ernest A., Jr. An improved type of fluoroscopic foot-switch. *Radiology*, March, 1950, *54*, 428–429.

A description of a foot-switch is given for use during fluoroscopy with table horizontal. In series with the regular switch used with table vertical, there is another switch fixed permanently to the base of the table at the side. It consists of a long metal plate suspended parallel to and just above the floor, in contact with the springs of two actuator type micro-switches, wired in parallel and normally open. Pressure against any portion of the plate with the foot closes the micro-switches and energizes the fluoroscopic tube.—*A. W. Sommer, M.D.*

Cole, J. W., Shaw, D. T., and Fraser, P. Wound healing: cutaneous and serum inhibition of hyaluronidase; an experimental study. *Surg., Gynec. & Obst.*, March, 1950, *90*, 269–274.

The physiology of healing wounds still remains a perplexing problem. In recent years considerable attention has been focused on an antercellular cement substance in tissues. One of the substances constituting the intercellular cement material is an acid mucopolysaccharide called hyaluronic acid. Another is chondroit-insulfuric acid. The biological role of hyaluronic acid remains somewhat inconclusive but evidence seems to indicate that it may serve as a viscid medium for the deposition and growth of cellular elements in regenerative and reparative processes.

In 1928 Duran-Reynals employing extracts of rodent testes, demonstrated an enhancement of the infectivity in rabbit skin of the vaccine virus when used in combination with the testicular extract. The active principle of the extracts was referred to as the "spreading factor" of Duran-Reynals. It is generally accepted that the active constituent of the testicular extract was hyaluronidase.

It has been conjectured that the normal physiological response to trauma is intimately associated with the hyaluronic acid hyaluronidase system in the body. If the liberation of hyaluronidase at the site of injury is postulated it seems reasonable to assume that the normal response would be inhibition of this enzyme permitting the laying down of hyaluronic acid and chondroitinsulfuric acid as intercellular cement substance incident to tissue repair. With this viewpoint in mind the authors undertook the demonstration of cutaneous inhibition, inhibition of hyaluronidase spread in animals with simple wounds and the correlation of this with the serum inhibitor titer in the same animal.

Summary.

1. A group of 6 rabbits was operated upon and the

effects of the operative trauma and healing wounds on hyaluronidase activity were studied with the biological assay method.

2. Following operation there was a prompt decrease in the spreading effect of hyaluronidase when injected intracutaneously and a concomitant rise in the serum inhibitor of hyaluronidase in the sera of the animals operated upon.

3. The cutaneous inhibition remained marked from the second to the fifth postoperative day. The serum inhibitor was elevated from the first to the sixth postoperative day with a peak being noted between the second and fourth days.—*Mary Frances Vastine, M.D.*

Pollak, Otakar J., and Leonard, Adeline. Diagnostic value of the iodoacetate index (Huggins-Miller-Jensen test). *J.A.M.A.*, March 25, 1950, *142*, 872–875.

Huggins-Miller-Jensen found that the majority of blood serums of patients with malignant growth show deficient heat coagulation when treated with iododacetic acid, while only a minority of serums of patients with non-neoplastic disease have the same chemical property.

The present authors attempt to further study the reliability of the test and report in detail their technique of carrying out the test on 250 patients. Eighty patients suffered from neoplastic disease as diagnosed by biopsy, cell block, surgical specimen, or necropsy. One hundred and seventy persons were in good health, had minor impairment of health, or were severely ill, but their disease was not of a neoplastic character. In these, obviously, a new growth could not definitely be excluded except in persons who died and on whom a post-mortem examination was performed.

Based on the arbitrary selection of an index of 9.70 as the maximum correct positive and 9.71 as the lowest correct negative result, they grouped their results into correct positive, false positive, correct negative, and false negative.

Group I (correct positive) results were obtained in 73 persons having histopathologically proved tumors of varying sites as follows: skin 4, vulva 1, cervix 8, uterus 4, ovary 5, breast 10, testis, 1, prostate 4, kidneys 3 , lung 4, stomach 3, cecum 1, colon 8, sigmoid 5, rectum 3, and pancreas 6, and Hodgkin's disease lymphosarcoma, and chronic myelogenous leukemia each 1.

Group II (false negative) results were obtained in 7. The known growths were in the thyroid, uterine fundus, breast, stomach 2, colon and rectum (4 of of these patients had metastasis).

Group III (correct negative) results were obtained in 147. The persons included healthy young women 10, pregnancy 33, respiratory disease 12, diseases of the circulatory system 8, disease of the gastrointestinal tract 15, disease of the liver and gallbladder 8. The remainder had widely divergent conditions.

Group IV (false positive) results were obtained in 23. Three of these died and at necropsy the causes of death were uremia due to chronic glomerulonephritis, traumatic intracranial hemorrhage and cerebral hemorrhage, and bronchopneumonia. The clinical diagnoses of the other 20 were pregnancy, osteoid osteoma, bronchopneumonia, lobar pneumonia, peptic ulcer, cholelithiasis, chronic prostatitis, benign hypertrophy of the prostate, ovarian endometriosis, leiomyoma of the uterus, fibroadenoma of the breast, diabetes, pulmonary tuberculosis, and so forth.

After a very careful analysis of the findings it was concluded that this reaction is not suitable as a diagnostic test.—*R. K. Arbuckle. M.D.*

Castex, M. R., Maggi, A. L. C., and Meeroff, M. Secreción y motilidad gástricas; su modificación por el tetra-etil-amonio. (Gastric secretion and motility; their modification by tetraethylammonium.) *Prensa méd. argent.*, March 3, 1950, *37*, 404–411.

Burn and Dale demonstrated in 1912 that tetramethylammonium excites the vagus endings in mammals by rendering the ganglion cells more receptive to the stimuli arriving from the preganglion fibers. If the dose is considerably increased, the action is reversed and a paralysis results; in other words, exactly the opposite occurs of what is observed in batrachia. Hunt in 1926 found that if the higher homologues of the above-mentioned quaternary ammonium compound, and in particular, the tetraethylammonium, are used the same paralyzing effect is produced with much smaller doses.

The authors studied this paralyzing effect of the tetraethylammonium on the secretion and motility of pathologic stomach in humans.

The 10 per cent aqueous solution of tetraethylammonium chloride, known under the trade name of etamon, was used and a dose of 15 mg. per kg. body weight was injected intramuscularly. All patients were hospitalized to avoid undue interference from other factors and medication of any sort was discontinued at least fifteen days prior to the examination.

The series of study of the gastric secretion included 18 patients afflicted with gastric or duodenal ulcer. The stomach was aspirated six hours after the injection of the drug. It was found that (1) the gastric acidity decreased in 88 per cent, (2) there was a parallel decrease of the quantity of gastric juice in an equal percentage, (3) the post-caffeine secretion was influenced qualitatively in a like manner with a similar percentage of decrease, (4) but the quantity of the post-caffeine secretion remained essentially unmodified, (5) the inhibitive action of the drug, especially following several injections, lasted as long as fifty-four hours and (6) there was notable

amelioration of the nocturnal pain due to the ulcer.

The study of the gastric motility was carried out on 15 patients, 9 of whom had duodenal ulcer, 3 duodenal ulcer with some other complication, 2 gastric ulcer and 1 neoplasm of the lower esophagus. The barium meal was given three hours after the injection and the stomach was examined roentgenographically and roentgenoscopically for its size, form, tonus, contractility and evacuation. It was found that tetraethylammonium (1) diminishes the gastric tonus in approximately 50 per cent of the cases, (2) markedly decreases the contractility of the stomach in more than 90 per cent of the cases, (3) is a good therapeutic measure in pain due to gastroduodenal hypermotility, (4) it has an effect which lasts considerably longer than the three hours indicated by Neligh and Lyons and (5) one may surmise that it also has a similar inhibitory effect on intestinal hypermotility.

If administered intramuscularly the drug is well tolerated. Temporary dryness of the mouth, visual disturbance and hypotension are occasionally observed. No medication is necessary to combat them. —*T. Leucutia, M.D.*

Lenzi, M., and Magri, G. Experimental studies on the organo-localisation and following mobilisation of the colloid thorium-dioxide. *Indian J. Radiol.*, Feb., 1950, *4*, 1–12.

Thorotrast, when injected intravenously into rabbits, localizes selectively in the liver and the spleen. These organs then become radiopaque. With these facts in mind, the authors attempted to find a method of exciting a specific localization of thorotrast in a fixed place outside of the hepatosplenic reticulo-endothelial system. If this could be done, thorotrast could be used as a contrast medium and also as a secondary irradiator in a therapeutic manner.

Animals were treated with thorotrast and various extracts from the liver, spleen and other organs were then given. These did not modify the affinity of thorotrast for the hepatosplenic reticulo-endothelial system. Other animals, following the injection of thorotrast, were given 500 r per day for three days localized to the spleen. Roentgenograms made prior to, and two months after the irradiation, revealed the liver and the splenic shadows to be more opaque and smaller. This contraction of the liver, and particularly the spleen, was more marked in the animals that had received the extracts from the various organs. The authors believe that their experiments confirm the strong action of the irradiation on the hepatosplenic system previously impregnated with thorotrast.—*F. J. Rigos, M.D.*

Campi, L., and Abeatici, S. Ulteriori ricerche sperimentali sulle lesioni istologiche delle pareti arteriose causate da prodotti organo-jodati impiegati in arteriografia. (Further experimental investigations on histopathological lesions of the arterial walls caused by organic-iodide compounds used in arteriography.) *Radiol. med.*, April, 1950, *36*, 312–318.

In a previous communication the authors had considered the effects of neo-pielofanina, and of joduron, two of the organic iodides available in 1948 in Italy.

The compounds studied in this paper were ténébryl (diiodomethansulphonate of monoethanolamine) and diodrast (3, 5 diodo-4 pyridone-N-acetic acid diethanolamine), known in Italy by the trade name diodone.

The experimental animals employed were young dogs. Following general anesthesia by intraperitoneal injection of chloral hydrate and morphine, the femoral artery was exposed at the level of the coxofemoral articulation. The iodide compound was injected in quantities of 1 to 5 cc.; one to three injections were given at intervals not exceeding twenty-four hours.

From two hours to fifteen days later, the animals were sacrificed and sections of the artery were obtained distal to the bifurcation of the deep femoral artery. Sections from the contralateral artery were used as controls.

No histopathological lesions of the arterial wall were demonstrable following the use of 70 per cent diodrast.

The 110 per cent solution of ténébryl, when used in high and repeated doses, caused productive lesions consisting mainly of proliferation and rugosity of the intima. In one case a small thrombus was observed.

The authors suggest that two types of mechanism may cause the lesions of the arterial wall: (1) a direct action on the endothelium with ulceration, hematoma, thrombosis, and complete sclerosis of the artery, such as was demonstrated in some cases following the use of neo-pielofanina and joduron in their first experiment; (2) a reflex action with spasm producing proliferation of the intima, such as was observed in the use of ténébryl.

Seventy per cent diodrast solution in the quantities used caused no demonstrable histopathological changes.—*A. A. Blasi, M.D.*

Rocha, Maurício. Prova de Manuel Estiu nas concreções do hipocôndrio direito. (The Manuel Estiu test for concretions in the right hypochondrium.) *Rev. brasil de gastroenterol.*, March–April, 1950, *2*, 185–194.

The author describes a roentgenographic technique which facilitates the differential diagnosis between renal and biliary calculi by the simple means of lateral flexion of the trunk either to the right or to the left with the patient standing. In assuming these

positions the gallbladder moves horizontally (in pendulum fashion), laterally in left flexion, medially in right flexion. The kidneys and the other viscera show vertical excursion on flexion of the trunk: on flexion to the right the right kidney moves downward, the left upward; on flexion to the left, the right kidney moves upward, the left downward. This renal vertical shift amounts to 4 to 8 cm. The conclusions based on the author's technique proved correct in all of his 15 operated cases.—*E. A. Schmidt, M.D.*

BUCHS, S., and FROMMHERZ, G. Die technischen Apparaturen der Angiokardiographie. Ihre Indikationen und Kontraindikationen. (Technical apparatus for angiocardiography, their indications and contraindications.) *Schweiz. med. Wchnschr.*, April 8, 1950, *80*, 347–349.

After briefly referring to the disadvantages of various angiocardiographic devices with manual and mechanical cassette changers, the authors describe their giant roll-film camera, which operates partly mechanically but chiefly electromagnetically. The entire apparatus including the control panel is built-in under the table. The framework of the latter is similar to the ordinary hospital-type table-stretcher on wheels. The table top has a bakelite window large enough for the usual exposures in roentgenographic technique. By means of suitable electrical hook-ups, the overhead roentgen tube is connected to the control panel. After selection of all the desired factors, a simple foot-switch sets the automatic process in motion.

The roll-film measures 20 m. by 24 cm. Exposures are taken at intervals of 0.6–1.5 sec., but the apparatus is adjustable to speeds above or below these extremes. In angiocardiography, the roentgenograms are 24 by 30 cm. for adults and 24 by 18 cm. for children. A large built-in knife cuts the film when desired. No grid is used.

Angiocardiography is performed on cases suspected of having anomalies of the heart or great vessels; also, to differentiate vascular from non-vascular mediastinal masses. None of the patients had side-reactions to the 70 per cent iodine compounds, but the authors mention shock due to sudden dilatation of the ventricles and precordial pain due to underoxygenation of cardiac muscle. Children are anesthetized for the injection, which is followed by an infusion of physiological saline. Iodine sensitivity tests are performed routinely. The contraindications are listed as folllows: (1) cardiac insufficiency (2) endo- and myocarditis; (3) coronary artery disease; (4) arrhythmias: (5) liver diseases; (6) kidney diseases; (7) allergic diatheses.—*J. Zausner, M.D.*

CAMPBELL, JOHN A., and LOCKHART, PHILIP B. Improved vertical and horizontal multiple cassette changers for contrast angiography. *Radiology*, April, 1950, *54*, 559–566.

Three manually operated multiple cassette changers for contrast angiography are described, one for vertical, one for horizontal and one for both horizontal and vertical roentgenography.

A modification of Schwarzchild's vertical rapid cassette changer for production of 10 by 12 inch serial angiocardiograms is described. Cassettes are fed in succession from a gravity magazine with a capacity of 20 cassettes, across the front of the apparatus by a hand-operated thrust bar. Exposure is made on the return stroke of the thrust bar, which activates a switch connected in series with the timer circuit. Each operation of the thrust bar positions an unexposed cassette, which serves as a positioning stop before it drops into a drop-out chute. Variations from Schwarzchild's design are described.

A horizontal rapid changer, utilizing the same principle of a manually operated thrust bar similar to the vertical model, is described for use with the patient recumbent. Arrangement is outlined for incorporating a device to record on each film the time of exposure relative to the start of the injection.

To permit the taking of both anteroposterior and lateral roentgenograms with the head remaining face up in one position, a manually operated changer is used, embodying both vertical and horizontal loading magazines at right angles to each other. Each magazine holds three cassettes. Manual removal of the top cassette after exposure automatically positions the next cassette.

Adaptability, simplicity, low construction cost, and ease of operation are emphasized.—*A. W. Sommer, M.D.*

MCALLISTER, FERDINAND F., and BECK, C. S. A new x-ray technic for visualization of the heart and great vessels. *Circulation*, April, 1950, *1*, 1049–1051.

In this experimental study a No. 6 or No. 8 olive-tipped cardiac catheter, fitted with a deflated balloon similar to the arrangement of the Miller-Abbott tube, was inserted into the external jugular vein of the heparinized animal, usually a dog. The catheter was advanced into the right ventricle or into one of the branches of the pulmonary artery. About 20 or 30 cc. of air or opaque material was injected into the balloon and a roentgenogram was made. In this way good visualization of the cardiac chamber or great vessel in which the catheter and balloon were situated was obtained. Upon withdrawal of the catheter, similar studies were made of the pulmonary artery, right auricle and great veins.

This procedure is not recommended for human subjects until a catheter is designed which will prevent the adherence of clots to irregularities in the surface of the balloon.—*Gerald Lavner, M.D.*

MACARINI, N., and OLIVA, L. La stratigraphie axiale transversale dans la pathologie. (Transverse axial stratigraphy in pathological

conditions.) *J. belge de radiol.* Dec., 1949, *32*, 187–213.

Transverse axial stratigraphy is performed with an apparatus which turns the vertical patient and horizontal film synchronously on parallel vertical axes. The axes of rotation and the focus of the roentgen tube are in the same geometric plane. The tube is fixed and the angle of the roentgen rays to the film is markedly oblique. The method is given its name because layers are obtained in axial projection with the roentgen rays in a transverse direction (Vallebona). Application of the method to several cases with pulmonary lesions is illustrated.

The first case was one with a tuberculous cavity treated with streptomycin and para-amino-salicylic acid. The exudative lesion around the cavity resorbed but the cavity was unchanged. The patient was referred for roentgenologic examination prior to surgery. The conventional roentgenogram showed a large cavity in the left parahilar region, bronchopneumonic foci which were largely sclerosed scattered throughout the hemithorax and hilar calcifications, particularly on the right. Frontal stratigraphy yielded details of the cavity. It was shown to be adjacent to the left hilus. Its shell was thick, its margins irregular, and it contained air. The condition of the adjacent lung was established. Transverse axial stratigraphy was performed in order to obtain an over-all impression of the relations of the cavity particularly to the thoracic wall. A layer through the hilus showed posteriorly and in the midline the shadow of the eighth dorsal vertebra of which the body, the pedicles, the lamina outlining the medullary canal, and the spinous process were made out. The eighth rib was partially outlined on both sides. In front of the vertebral body and to the left of the midline, there was a circular opacity corresponding to a section of the thoracic aorta. Farther forward, there was an irregular trapezoid due to the heart and great vessels sectioned transversely at the level of the left auricle. On each side of the mediastinum, there were two irregular shadows directed towards the pulmonary fields, corresponding to the hila.

In the right hemithorax, several opaque streaks were seen extending from the hilar region toward the posterior thoracic wall. These corresponded to the sclerotic bands noted on the conventional film. In the left hemithorax, the cavity was seen posteriorly as it appeared in the frontal stratigram. It was situated in the posterior costomediastinal sinus in contact with the thoracic wall. The shell again was found to be thick and there was no lesion in the adjacent lung. However, in addition, it was shown that the largest diameter of the cavity was oriented anteroposteriorly.

Hence, in this case, in addition to a precise study of the shape and shell of the cavity, stratigraphy provided localization. But, while frontal stratigraphy demonstrated the proximity of the cavity to the posterior wall, only transverse axial stratigraphy showed its intimate contact with the costomediastinal sinus and the anteroposterior orientation of its largest diameter.

Case 2 was one of extrapleural pneumothorax. Here the method established the exact location of the extrapleural pocket, the thickness of the shell and the condition of the neighboring lung parenchyma. A slight displacement of the anterior mediastinum also was seen.

Case 3 was one of abscess at the right base, which had not been improved by repeated surgical intervention. Conventional roentgenography was not helpful because the right base was obscured by previous rib surgery. Stratigraphy defined the size and location of the abscesses. One was localized primarily in the middle lobe. As a result, the diaphragm was elevated and deformed and the heart was drawn to the right. Transverse axial stratigraphy gave a more precise localization of the cavities in the midst of the pulmonary infiltrations and their relation with the hilus and thoracic wall. These findings were more evident than on the frontal stratigrams.

Several other cases are presented all of which lead to the conclusion that while roentgenograms obtained in this way are difficult to interpret, the results are superior to other previous techniques.—*M. L. Sussman, M.D.*

Paatero, Yrjo V. A new tomographical method for radiographing curved outer surfaces. *Acta radiol.*, Sept., 1949, *32*, 177–184.

A new tomographic method is presented for roentgenographing curved outer surfaces. Experiments in this method have been successful in producing "cranial charts" of the outer surface of one-half the skull in much the same manner as a map of the globe is reproduced on a plane surface. This effect is obtained by projecting roentgen rays through a small slit and thence through the skull onto a semi-cylindric film cassette applied closely to the portion of the skull to be roentgenographed. At the same time the patient is rotated 180 degrees in a rotating chair. A similar projection is obtained by using a linearly moving plane cassette. The author feels that further experimentation may well prove this method to be useful in roentgenographing other curved surfaces such as the thoracic cage.—*D. E. Vivian, M.D.*

Debain, J. J. Enquête aux Etats-Unis sur l'emploi de la sonde de radium dans le nasopharynx. (Investigation in the United States on the use of nasopharyngeal radium applicator.) *Ann. d'oto-laryng.*, Feb.–March, 1950, *67*, 144–151.

The author, from the Institute of Cancer of Paris, was invited to the United States to investigate the therapeutic value of the nasopharyngeal radium applicator, because a great deal of criticism and confusion exist in France concerning its use. His findings were based on a critical study of the pertinent literature, observation and discussion of results of beta

therapy of nasopharynx with leading American specialists, as Crowe (who started using radon in 1924). They are as follows: (1) The treatment has not caused any harm to growth, bones or cartilages, nor has it affected the hypophysis. (2) The effective dose (tissue dose) is grossly approximative. Besides self absorption, 75 per cent of the beta rays are absorbed by 3 mm. of lymphoid tissue. Very slight variations in the position of the applicator reduces considerably the effective dose. This explains the greater number of failures. Hence, if success in treatment is to be achieved, the technique of application should be impeccable. The physician handling the radium should not neglect radiation protection measures. (3) Acute infections should not be treated, while in chronic stages the dose should be diminished and the intervals between the treatments lengthened. Previous roentgen, radium or radon therapy should be taken into careful consideration. (4) The treatment is useful only in postadenoidectomy cases of persistence or reappearance of lymphoid tissue at the fossa of Rosenmüller and the tubal orifice. Beta therapy can prevent deafness in such cases. It is of proved therapeutic value in (a) deafness due to chronic catarrh of the eustachian tubes, (b) aerootitis, (c) recurrent nasopharyngeal infections or otitis, (d) asthma of infectious origin.—*J. N. Sarian, M.D.*

Goldstein, L. A., and Dreisinger, F. Spot orthoroentgenography; a method for measuring the length of the bones of the lower extremity. *J. Bone & Joint Surg.*, April, 1950, *32A*, 449–452.

A simple device is described using existing roentgenographic apparatus, a special, though cheap, brass cylindrical extension cone and the conventional 14 by 36 inch cassette. Using a 40 inch target focus distance, exposures are short and localization accurate. Wrist and forearm for bone age determination are taken on the same film. The brass extension cone has many other uses such as taking of lateral roentgenograms of the femoral neck, paranasal sinuses or for spot roentgenograms of any part of the body.—*J. W. Karr, M.D.*

Moon, Henry D., Simpson, Miriam E., Li, Choh Hao, and Evans, Herbert M. Neoplasms in rats treated with pituitary growth hormone. I. Pulmonary and lymphatic tissues. *Cancer Research*, May, 1950, *10*, 297–308.

The histogenesis of pulmonary lymphosarcoma in 15 female rats which had been injected intraperitoneally with pure pituitary growth hormone daily for a maximum of 485 days is the subject of this report. A similar control group of animals received parenteral injections of an inert protein (albumin).

In 6 of the 15 test animals, lymphosarcomas of the lung developed. Involvement of hilar and mediastinal lymph nodes was seen in 4 animals. The control rats did not develop such tumors. All 15 of the injected rats showed hyperplasia of peribronchial lymphoid tissue. The lymphosarcomatous lesions developed in the areas of lymphoid hyperplasia. Such lymphoid hyperplasia or lymphosarcomatous transformation could not be consistently demonstrated in other organs normally containing an abundant amount of lymphoid tissue.

Histopathologically, neoplastic reticulo-endothelial cells, lymphoblasts, and lymphocytes were the three types of cells representing various stages of differentiation seen in all tumors. Usually one type of cell predominated and occurred in large masses.

Many photomicrographs demonstrate the changes described. Prolonged administration of pituitary growth hormone in rats definitely produced neoplastic lymphosarcomatous transformation in areas of peribronchial lymphoid hyperplasia.—*K. L. Krabbenhoft, M.D.*

Moon, Henry, D., Simpson, Miriam E., Li, Choh Hao, and Evans, Herbert M. Neoplasms in rats treated with pituitary growth hormone. II. Adrenal glands. *Cancer Research*, June, 1950, *10*, 364–370.

This paper deals with the hyperplastic and neoplastic changes in the adrenal glands of rats which had been given pituitary growth hormone. A previous report dealt with the histogenesis of pulmonary lymphosarcoma in this same group of animals. These normal plateaued females were given pituitary growth hormone for 350 to 485 days with an initial dose of 0.4 mg. gradually being increased to 3.0 mg. per day toward the end of the experiment.

The adrenal cortices in 6 of 15 test rats showed increased nodularity, and 1 had a cortical adenoma. Only 2 of the control animals showed cortical nodularity. Adrenal medullary tissue in all of the test rats was increased in amount due to cellular hypertrophy and proliferation. This change has been produced by other investigators as a result of the administration of thiouracil. In 10 of these rats evidence of neoplastic invasion of the cortex was seen and 3 of them exhibited macroscopic medullary tissue on the surface of the gland. The medullary hyperplasia varied from focal areas of atypical cells to tumors which had grown through the cortex and capsule, suggesting that the small focal areas were early neoplastic lesions. The medullas of the control rats exhibited no abnormality.

The authors have given a detailed histological account of the normal and abnormal glands, presented several splendid photomicrographs and shown conclusively that prolonged administration of pituitary growth hormone causes hyperplastic and neoplastic changes in the adrenal medulla and

adrenal cortical nodularity in rats.—*K. L. Krabbenhoft, M.D.*

Grad, B., and Stevens, C. E. Histological changes produced by a single large injection of radioactive phosphorus (P^{32}) in albino rats and in C3H mice. *Cancer Research*, May, 1950, *10*, 289–296.

This study was made to determine the immediate effects of P^{32} on cytological structures and the location of these effects. Young male and female albino rats and adult female C3H mice bearing mammary tumors were used. A single large dose of P^{32} was injected subcutaneously and the animals were sacrificed two hours to nine days later.

Pyknosis and karyorrhexis of mitotic nuclei and enlargement of metabolic nuclei were the most predominant evidences of cellular destruction. Vacuolation and reduced staining ability of the damaged cells were seen. Lymphatic organs, the bone marrow, the small intestine, the granulosa of ovarian follicles, and mammary tumors were most susceptible to the cytologic destructive action of P^{32}. Massive degeneration and pyknosis appeared in the crypts of the small intestine. Scattered pyknotic cells at twenty-four hours, large blood lakes at forty-eight hours, and necrosis and liquefaction of most of the tumor at nine days were observed in the mammary tumors. Normal mammary tissue remained unaffected.

The stomach, colon, seminiferous tubules of the testis and the hair follicles were intermediate in their degree of susceptibility to the toxic effects of P^{32}.

The salivary glands, pancreas, liver, genitourinary system, endocrine glands (except the ovary), brain, muscular and connective tissue were least susceptible and showed little or no destruction of the cellular structure.

The histopathological changes observed are markedly similar to those seen resulting from intensive roentgen therapy.—*K. L. Krabbenhoft, M.D.*

Miller, C. Phillip, Hammond, Carolyn W., and Tompkins, Marianne. The incidence of bacteremia in mice subjected to total body x-radiation. *Science*, May 19, 1950, *111*, 540–541.

The authors investigated the role of infection as one of the features of radiation sickness. Mice were given total body irradiation in a single exposure using 20 kv., 15 ma., 27 inch distance and 0.5 mm. Cu plus 3 mm. bakelite filter. One group of 585 mice were given 600 r and another group of 1,042 mice were given 450 r.

Several mice from each group were killed daily after the second post-irradiation day. Blood was removed aseptically from the heart and planted on nutrient and blood agar plates. Various organs were cultured in broth. Anaerobic cultures were also made.

In the group that had received 600 r the highest daily incidence of positive culture (85 per cent) occurred on the ninth day which was also the day on which the greatest number of animals died (9 per cent). A rough estimate of the severity of the bacteremia showed that 35 per cent of the culture plates had innumerable colonies scattered about.

In the animals that had received 450 r the greatest mortality occurred at the time of the high incidence of positive culture also. This, however, was not as great as in the 600 r group; only 20 per cent of the culture plates revealed innumerable colonies.

The organisms found upon the culture plates were all species present within the large bowel with one minor exception. The lower intestinal tract was the reservoir from which invasion of the blood stream occurred. In both groups 91 per cent of the cases of bacteremia were due to a single organism, and in the remaining 9 per cent no more than two species were seen.

It is during the second week after irradiation, the period of greatest mortality, that bacteria from the lower intestinal tract invade the blood stream and produce bacteremia. The maximum incidence of such infections in mice exposed to 600 r or 450 r of roentgen radiation was 85 per cent and 54 per cent respectively.—*F. J. Rigos, M.D.*

Rekers, Paul E., Coulter, Molly P., and Warren, Stafford L. Effect of transplantation of bone marrow into irradiated animals. *Arch. Surg.*, April, 1950, *60*, 635–667.

Single dose of whole body roentgen irradiation is known to produce alteration in the hematopoietic system due to the direct effect of irradiation. The mechanism is not known. This study was undertaken to determine if any benefit is to be derived from transplantation of normal bone marrow elements to animals which have suffered alteration of bone marrow from irradiation.

Precise evidence for definite favorable results from such transplantation of bone marrow is not available. Likewise explanation for successful transplant of homografts and heterografts of certain tissues is lacking. In the present study five methods of transplantation of marrow elements or complete bone segment were used. These were: transplantation of marrow suspension (into marrow cavity); transplantation of bone cap with marrow; transplantation of rib segment; intravenous infusion of marrow suspension, and transplantation of marrow fragments to anterior ocular chamber. Two control groups of animals (dogs), irradiated without following marrow transplant, were also used.

The intramedullary transplant studies, comprising the first two methods listed above, indicated no myeloid regeneration occurring from the suspension or bone cap with marrow transplants. Recovery of normal circulating blood elements was no more

rapid in those animals surviving irradiation and transplant than in animals surviving irradiation without transplant. Of the extramedullary transplant methods only that with intravenous infusion of marrow suspension suggested a favorable result. The animals surviving irradiation followed by intravenous infusion of bone marrow elements showed an increase of the total white blood cell count, and of the absolute lymphocyte and reticulocyte values in the peripheral blood. A pathologic finding of interest in these animals surviving after infusion was the presence of many small areas of bone formation in the lung within the small veins. Typical myelopoiesis at these sites was not identified. Marrow transplant to spleen, both normal and irradiated, to spleen of animal with total body irradiation, to the eye, subcutaneous tissue, muscle and peritoneum again failed to demonstrate myelopoiesis.

Studies were then initiated in an attempt to determine the factors influencing extramedullary myelopoiesis. The following factors were investigated: demand on the part of the recipient, quantity of material transplanted, adequate vascularization of the transplant, compatibility of donor and recipient marrow and age and development of the transplanted material. No single factor was found to increase the likelihood of myeloid regeneration of transplanted marrow. In autologous marrow transplants to the anterior chamber of the eye of rabbits, the subcutaneous tissue of the ear and the muscle of the anterior abdominal wall, there were occasionally found groups of normal marrow cells only in the anterior ocular chamber. Transplant of embryonic tissue was no more successful than of adult tissue.—*D. F. Anderson, M.D.*

LAUGHLIN, J. S., and DAVIES, W. D. Procedure in dose distribution measurement of 25-Mev x-rays. *Science*, May 12, 1950, *111*, 514–516.

Depth dose and isodose distribution measurements of 25 mev. betatron radiation were made by the authors by two techniques—small ion chamber measurements and roentgen film density response.

Ionization measurements were made in a water-filled phantom with the position of the ion chamber remotely controlled by selsyn motors. With this mechanism, a complete isodose distribution could be obtained in a single, uninterrupted operation of the betatron. Checks indicated a variation of not greater than 1 per cent in dosage measurements.

In the second method, industrial roentgen films were inserted between the sheets of a presdwood phantom. The roentgen-ray beam was collimated to a circular cross section of 5 cm. diameter at 80 cm. skin-target distance.

The measurements indicated that with this type of radiation the skin dose appeared to be about 8 per cent of the maximum dose which occurred at a depth of about 4 cm.—*L. K. Sycamore, M.D.*

ENGSTRÖM, ARNE, and GLICK, DAVID, The mass of gastric mucosa cells measured by xray absorption. *Science*, April 14, 1950, *111*, 379–380.

The utilization of selected bands in a long wavelength continuous roentgen-ray spectrum makes it possible to determine the dry weight of single cells and cell structures by absorption measurements. Mass can be determined by roentgen-ray absorption techniques with an over-all error under 10 per cent

The mucosa of a dog's stomach was specially frozen and dehydrated and mounted on a brass disc. A roentgen-ray beam with a maximum wavelength of 8–12 Å was employed. Special film with a resolving power of about 1μ was used to record the radiation intensities. Thin strips of nitrocellulose film simultaneously exposed were used as a reference system.

The microradiograms were enlarged and studied together with photomicrographs of the same sections. The results demonstrate that the nuclei show less absorption than the secretion-free cytoplasm, while the secretion itself within the cytoplasm has the greatest absorption. The mucus and enzyme-secreting cells have a greater mass than those secreting acid. The greatest variability occurs in the chief cells which is probably due to different stages of secretory activity.—*R. A. Hays, M.D.*

PAFF, GEORGE H., and SEIFTER, JOSEPH. The effect of hyaluronidase on bone growth in vitro. *Anat. Rec.*, April, 1950, *106*, 525–537.

Chondroitin sulfuric acid is contained in the matrix of hyalin cartilage. This matrix is systematically eroded in the process of endochondral bone formation. Since chondroitin sulfuric acid is a substitute for the enzyme testicular hyaluronidase, the authors performed this study to determine the effect, if any, of testicular hyaluronidase on the growth of long bones in vitro.

Paired six, seven, eight, and nine day old chick femurs were dissected out and used. One femur was placed in an 0.6 per cent hyaluronidase-tyrode solution for a given length of time, and the other was not. The femurs were then placed on a clot containing equal parts of chicken blood plasma and chick embryo extract, and were allowed to grow for varying lengths of time.

The hyaluronidase treated femurs in every experiment were smaller than their controls; however, there was no delay in the appearance of developing bone.

The cartilage matrix of the femur treated with the enzyme stained less basophilic than that of the controls, suggesting that the action of the enzyme upon the chondroitin sulfuric acid was responsible for the difference in staining quality.—*E. S. Reed, M.D.*